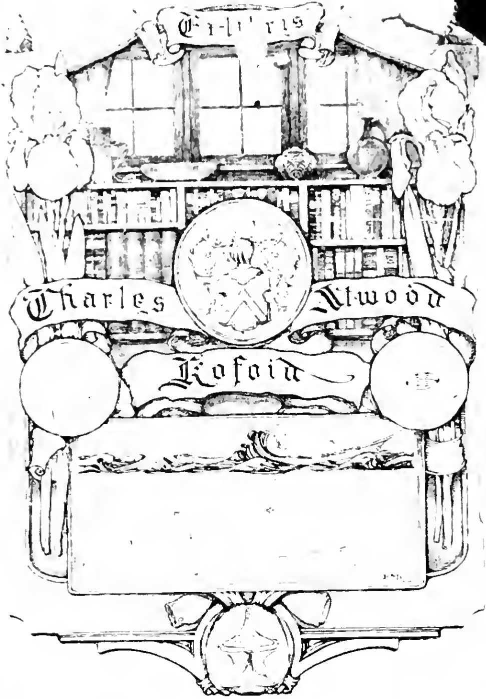

Mr. F. F. Stallknecht.

THE FARMER'S DICTIONARY:

A VOCABULARY

OF THE TECHNICAL TERMS RECENTLY INTRODUCED INTO AGRICULTURE AND HORTICULTURE FROM VARIOUS SCIENCES, AND ALSO A COMPENDIUM OF

PRACTICAL FARMING:

THE LATTER CHIEFLY FROM THE WORKS OF THE REV. W. L. RHAM, LOUDON, LOW, AND YOUATT, AND THE MOST EMINENT

AMERICAN AUTHORS.

EDITED BY

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WITH NUMEROUS ILLUSTRATIONS.

NEW-YORK:

HARPER & BROTHERS, PUBLISHERS,

82 CLIFF STREET.

1849.

PREFACE.

The Farmer's Dictionary was undertaken originally for the purpose of supplying a want long felt by the editor, in common with the agricultural community, of a short explanation of the many technical terms introduced into the works written on farming. Much opposition has arisen to the use of technical words in these productions, and our journals are full of complaints, from respectable men, against the innovation. If, however, words having so precise a meaning, and, in many instances, conveying so much information, be discarded, what shall be substituted in their place? It is obviously impossible for every writer who has occasion to use the terms hybrid, hydrogen, or eremacausis, to explain in detail what these mean; and if the attempt were made, our treatises would present the most tiresome examples of tautology. Each farmer may satisfy himself with a set of arbitrary terms, which convey all the information he desires; but they will not answer if he wishes to impart that information to others. There is, perhaps, no greater drawback to the advancement of our art than the indefinite words used among us—words which are often peculiar to a small district, and which are used to designate a variety of objects in different parts of the country. We find one writer using the word "withers" for the shoulders of an animal, another for the womb.

The friends of agricultural improvement, and especially our journalists, should use all exertions to establish a suitable nomenclature. The art has arrived at that stage that this is the greatest object to be accomplished. It will open to the practical man the extensive information of the scientific world, and will enable the theorist to study his generalizations by consulting the works of the true farmer. I have not, in attempting to carry out my original design of preparing a vocabulary, thought it advisable to insert every provincial phrase, but have taken only those words in common use among farmers, and which have become somewhat fixed by being frequently introduced into essays. I have thought it useful, when words were occasionally met with a strange signification, to omit them as an error in language; nor has it appeared conformable with my object to introduce the well-known words of our language which have a place in the common dictionaries. In this compilation I am necessarily under infinite obligations to others, especially to Loudon, Rham, Youatt, Stephens, Johnson, Deane, Young, Buel, Armstrong, Ellsworth, Colman, Low, Brande, Clater, &c., &c., and our journalists. My task has not been, however, without labour; for I could find no vocabulary such as that I desired to produce already in existence, to serve me as a model; and if any merit should be awarded me for this undertaking, it may be claimed on the ground that the FARMER'S DICTIONARY is the first book of its kind. This will also, I trust, avert much of the criticism to which I know the work is obnoxious. So much for my design, and the manner in which it has been accomplished.

In addition to the vocabulary, my friends have suggested the introduction of short and practical essays on the operations of farming; and these have been introduced the more readily, from the facility with which they were procured from the works of the Rev. W. L. Rham, one of the best practical writers of Britain, and others, as Loudon and Low, of great merit, and but little known in the United States. In this part of the work, care has been taken to edit the essays so as to make them of practical value in this country. To the journalists of the United States I am also deeply indebted for the matter introduced, and for which I have uniformly given them credit.

To most of the crops raised in the United States, an *Appendix* has been made of the composition of the *ashes*, and remarks offered on the SPECIAL MANURES. This has been done in consideration of the existing desire for information on the topic, and the impression that the most suitable manures for plants are discoverable by a study of their ashes. The best theories of the *chemical school* of agriculture are also introduced. In this part of the work, I am indebted to the labours of Chaptal, Davy, Braconnot, Saussure, Berthier, Berzelius, Sprengel, Hermbstaed, Payen, Johnston, Boussingault, Dumas, Thaer, Liebig, Mulder, Fownes, Fresenius, Will, Hertwig, Kane, Shephard, and other chemists.

D. P. GARDNER.

THE

FARMER'S DICTIONARY.

ABATTOIR. A building for the slaughtering of animals.

ABDOMEN. The region of the body containing the stomach, intestines, liver, spleen, &c. In insects it is the third division of the trunk, in spiders the second.

ABIES. The *Fir* genus of trees. See *Pinus*.

ABNORMAL. Irregular or unusual: applied to deviations from the ordinary development of parts of animals or plants.

ABORTION. Miscarriage. In veterinary surgery, miscarriage, slipping, slinking, casting, or warping, all meaning the expulsion of the young at so early a period of pregnancy as to render it impossible for it to live. The immediate causes appear to be the death of the fetus, or derangement in the functions of the womb or its dependencies, arising from some external cause or causes operating on the mother. Among these causes may be reckoned too much or too little food, producing fullness or emaciation; sudden fright or sympathy with certain smells or sights, such as the smell or sight of blood, of bones, of horns, and particularly of the aborted fetus of another animal. Accidents, also, such as falls, bruises, over-driving, or fatigue, and the like, may frequently bring on abortion.

The signs of approaching abortion are, great languor, uneasiness, and restlessness, sometimes a discharge of bloody matter, and the sudden filling of the udder, similar to the signs of approaching delivery.

Abortion in the Mare.—Abortions very frequently happen among mares. This often arises in consequence of over-exertion during the latter period of pregnancy. Mares are liable, also, very frequently, to various accidents in their pastures, which may be the cause of their slipping their foal, such as kicks, tumbling into holes and ditches, over-exerting themselves to get over fences, and the like. On this account, when a mare is near her time, she should be kept by herself, in some convenient place. But there is another, and, we suspect, a very general cause of these accidents in mares; we mean a stinting of them in their food, either in quantity or quality. It appears, indeed, that some imagine that the mare, when she is in foal, may be turned out almost anywhere; but this opinion is ill-founded; for, although she does not require to be kept so high in condition as when she is at hard work, yet she is not to be turned out into a pasture where she may be in a manner starved: but how often do we see the mare in foal on the worst piece of ground in the whole farm, exposed, during the rigorous winter season, to endure the cold, as well as to put up with scanty food? On the other hand, when the mare is not worked at all, and indulged with too high keep, she is almost equally in danger of abortion, her high condition having a tendency to cause inflammation and other disorders; and these, deranging the reproductive organs, frequently produce miscarriage. It would seem, then, that moderate exercise and diet are best suited as means to avoid the misfortune of the premature exclusion of the foal.

Abortion in the Cow.—Abortion occurs oftener in the cow than in all other domestic animals put together. Perhaps it is one of the greatest annoyances the proprietor of cows has to encounter. The causes are frequently involved in obscurity; but it may be mentioned that an extremely hot and foul cow-house will now and then produce abortion, and similar to those in mares. Anything whatever, indeed, that seriously affects the health of the animal in general, or the state of the reproductive organs in particular, may do so. But abortion occurs again and again when no such causes as those enumerated can be traced. The disease, if such it may be called, as we think it may, is even said to be infectious. No sooner does it show itself in one animal than it is seen in another and another, till it has spread over the most part of the cow-house. Some say this is to be attributed to the odour arising from the things evacuated. Possibly it may be so; there can be no great harm, however, in acting as if we were assured that the mischief has its origin in the source so commonly supposed, provided we do not shut our eyes to any other which accident or investigation may reveal. In the mean time, the number of abortions may be diminished by carefully avoiding all those causes which are known to be capable of producing it. Let the cows be regularly fed; let their food be good, and in proper quantities; let them have water as often as they will take it; avoid sudden exposure to cold or heat; and, above all, let the cow-house be well ventilated. Prohibit all manner of rough usage on the part of those who look after the cows, whether they be pregnant or not. If any of them accumulate flesh too rapidly, gradually reduce their allowance; and, on the other hand, if any become emaciated, discover the cause and remedy it, always by slow degrees. Sudden changes in the matter or mode of feeding should also be avoided. The same sort of diet does not agree equally well with all the cows, and this, in general, is indicated by undue relaxation or constipation of the bowels; this should be watched, and removed at once. Attention to these, and many other minor circumstances, will amply repay the proprietor for the little additional trouble.

It is a remarkable feature in the history of this complaint, that those animals that have once miscarried are particularly liable to do so again at the same period of their succeeding pregnancy. Greater care is therefore requisite to guard against those causes which do, or are supposed to excite it. The treatment of abortion, when it does take place, differs not from that adopted in cases of parturition, only that the cow which miscarries should be removed, with all that belongs to her, from among pregnant cows.

If the signs of approaching abortion be discovered early, the accident may sometimes be prevented. If the cow is in good condition, then immediately let it be bled to the extent of five or six quarts, and the bowels opened with half a pound of Epsom salts, two ounces of Glauber's, or three or four ounces of castor oil, administered in a quart of gruel; but if the cow is in very poor condition, and the miscarriage is anticipated from her having been exposed to cold, avoid bleeding, and give her a warm gruel drink, with an ounce of laudanum in it. If after this abortion does take place, let her be kept in a comfortable place by herself; and if the after-birth has not passed off, let no injudicious and unnecessary administration of violent forcing medicines be given. Nature, with a little assistance, is generally equal to the perfect restoration of the animal.

Abortion in the Sheep.—Ewes are subject to abortion, in consequence of the numerous accidents they are liable to. A pack of hounds in pursuit of a hare got among a flock of sheep belonging to a farmer, and so hurried and alarmed them, that thirty out of a flock of two hundred ewes prematurely dropped their lambs. It is the same in sheep as in the other cases of domestic animals; scarcity of food, and exposure to severe cold, having a great tendency to make the ewes prematurely drop their lambs, or produce them weakly and crippled at the full time; and although there may be a little danger in giving too much food, such as allowing them to feed all the winter on turnips, the danger is trifling compared with the starving system.—(*Miller.*)

ABORTIVE. Deficient. A common term in botany, and signifying the absence of stamens or pistils, whereby fruit cannot be produced; but also used to designate the partial or complete obliteration of any other organ, as the leaf, petals, carpels, &c.

ABRAXAS. A genus of butterfly (Lepidopterous) insects of the family of geometers; one of which, the *A. grossulariata*, is the well-known gooseberry moth, the caterpillar of which destroys the leaves of currant and gooseberry bushes.

ABSCESS. A gathering or tumour containing pus; it is the result of accidents or impaired health; and is only of moment when it affects internal organs or is produced near joints. Abscesses in joints, especially the hock joint of the horse, often produce incurable lameness, and those of internal organs destroy life by enfeebling the system. Superficial abscesses are to be opened freely at their lowest point when the pus is well formed; and poultices are to be applied to encourage the discharge: the wound must be kept clean, and dressed daily. It is advisable to hinder the formation of the abscess by low diet, and scarifying the part with a lancet; but this is only serviceable in the first stages.

ABSORBENTS. In *veterinary medicine*, drugs that are given internally for the purpose of neutralizing any acid which forms in the stomach and bowels, in consequence of impaired digestion. Prepared chalk is generally used for this purpose; or carbonate of soda. Those medicines are likewise termed absorbents which are applied externally for absorbing moisture. Starch, calamine, flour, and the like, are employed in this way. They are sometimes dusted between folds of the skin when galled, and raw from friction, blisters, or grease. They are likewise useful in canker of the horse's foot, foul in the foot of cattle, foot-rot in sheep, and sores between the toes of dogs; and they are beneficial in some forms of mange, in staying bleeding, and assisting the cure of a wounded joint.

ABSORBENTS. In physiology, a class of vessels whose office is to convey the product of digestion and the residue of nutrition into the circulation, to be mixed with and repair the waste of the blood. They are divided into lacteals and lymphatics. The former are all situated in the cavity of the abdomen; and by extremely minute mouths, opening on the inner surface of the stomach and intestines, they receive the nutritious portion of the food, and carry it to a vessel which runs along the left side of the spine, and which, in its turn, empties itself into the left jugular vein.

The lymphatics are distributed over every portion of the frame. The uses of the lymphatics are to remove the residue of nutrition; and, when the supply of food is deficient, to remove such portions of the body as can be spared and converted into blood. The lymphatics ultimately empty their contents into the same vessel as the lacteals, and they follow, in their distribution through the body, the same course as the veins. In the horse they are liable to a disease termed farcy; and in all animals they are frequently inflamed in the neighbourhood of a sore.

ABSORBENT SOILS. Soils in such a state of improvement, or of so good a quality as to absorb moisture from the air.

ABSORPTION. The imbibition of fluids. In plants this takes place chiefly by the swelling terminations of the rootlets (the spongioles). In very damp weather, leaves and the green stems also absorb moisture from the air. Fluids and gases only can be absorbed, no insoluble matters entering plants. Absorption in animals is carried on by the lacteals and lymphatics.

ABSTERGENTS. Medicines used for resolving tumours. They are usually stimulating.

ABUTMENT. The solid part of a pier from which an arch springs.

ACACIA. Spinous leguminous trees, with small flowers collected in spikes or heads; they are usually of small size. Two or three insignificant species belong to the United States. The locust is often improperly called by this name.

ACARI. The family of mites.

ACCIPITRES. The order of birds containing the hawks, eagles, and similar birds of prey.

ACCLIMATE. To accustom or inure animals or vegetables to a particular climate.

ACER. The generic name of the maples.

ACERANS. A family of wingless insects without antennæ.

ACEROSE. In botany, leaves which are thin and sharp, such as those of the pine-trees.

ACETABULUM. In anatomy, *acetabulum* signifies the cavity of the hip joint. In entomology, it is the socket on the trunk in which the leg is planted.

ACETARIOUS PLANTS. Salad plants.

ACETATES. Salts containing acetic acid, of which the acetate of lead or sugar of lead is the most important in the arts.

ACETIC ACID. See *Vinegar*.

ACHENIUM, AKENIUM. A small bony fruit, containing a single seed, which does not adhere to the shell or pericarp, nor open when ripe.

ACHLAMYDEOUS. Plants which have neither calyx nor corolla, and whose flowers are consequently destitute of a covering, or naked.

ACICULAR. Sharp, like a needle.

ACIDS. For the most part, sharp, sour bodies, which redden litmus, and combine with metallic oxides or bases to form salts. Many are, however, destitute of sour taste. They are divided into organic and inorganic: the latter constitute the mineral acids. The organic acids are divided into vegetable and animal acids. The following are interesting in agriculture:

Mineral Acids.

The sulphuric. See *Sulphur*.
Muriatic. See *Chlorine*.
Silicic. See *Sand*.
Phosphoric. See *Phosphorus*.

Vegetable Acids.

Nitric. See *Nitrogen*.
Acetic. See *Vinegar*.
Carbonic. See *Carbon*.
Tannic. See *Tannin*.
Gallic. See *Tannin*.
Prussic. See *Hydrocyanic acid*.
Humic. See *Humus*.

Oxalic acid in the free state is found in the hairs of the *Cicer arictinum*, or chick pea. It is very common in combination with potash, in sorrels, docks, rhubarbs, &c., and with lime in lichens. It is a very soluble, crystalline, colourless solid, of intense sourness, and highly poisonous. The composition is $C_2 O_3 + HO$, the HO (water) being replaced by bases. A solution is used as a test for lime, which it precipitates from its solutions as a white, insoluble oxalate of lime.

Tartaric acid. Combined with potash, it abounds in the juice of the grape, and is also found in tamarinds, bilberries, &c. It is a white, crystalline body, of the composition $C_8 H_4 O_2 + 2 HO$, and is bibasic. The racemic acid is isomeric. A solution precipitates potash in the form of the white crystalline bitartrate (cream of tartar).

Benzoic acid gives an aroma to many balsams, sweet-scented grass, &c. Its formula is $C_{14} H_5 O_3 + HO$, and it is considered an hydrated oxyde of benzoyl, or Bz. $O + HO$.

Citric acid. This is the sour principle of lemons, cranberries, cherries, gooseberries, &c. It is a very soluble, crystalline solid, of the composition $C_{12} H_5 O_{11} + 3 HO$; but the crystals contain 1 and 2 atoms of water of crystallization besides.

Malic acid is the acid body of unripe apples, pears, plums, &c. In the insulated condition, it is a deliquescent crystalline substance of intense sourness, composed of $C_8 H_4 O_3 + 2 HO$.

Besides these, all oily bodies contain one or more acids. See *Oils*.

The *animal acids* are enumerated under that head. The acids in plants are, for the most part, combined with bases: potash and lime are the most common; but magnesia, soda, alumina, and iron are also found. Occasionally they are united with vegetable alkalies.

As food, the acids are not of much moment; they do, however, serve to sustain the heat of the body by furnishing carbon for the respiratory function.

ACINACIFORM. Of a curved figure, like the cimeter.

ACINUS. The small and separate carpels of a compound succulent fruit.

ACONITINE. The poisonous alkaloid of Monk's-hood.

ACORN. The fruit of the oak. That of the live oak and other species is sweet and agreeable: it is an admirable food for pigs, and in England commands 37½ cents the bushel.

ACOTYLEDONS. Plants destitute of seed-lobes, the cryptogamia of Linnæus, including fungi, mosses, sea-weeds, ferns.

ACRE. A standard land measure. The imperial acre is subdivided into

4 roods, each rood 40 perches.
160 perches, 16 feet and a half each.
4840 square yards, 9 feet each.
43,560 square feet, 144 inches each.
174,240 squares of six inches each, 36 inches each.
6,272,640 inches, or squares of one inch each.

From this table the farmer can readily discover how many plants can be set in the acre, according as they are one yard, one foot, &c., apart each way.

ACROGENS. The same as cryptogamia or acotyledons.

ACRID. A biting, nauseous taste, often producing blistering, belonging to many poisonous plants.

ACROLEIN. See *Glycerine*.

ACROSPIRE. The young upward shoot of germinating seeds.

ACRYDIUM. A genus of locusts.

ACTINOLITE. A variety of hornblende.

ACTINOMETER. An instrument to measure the intensity of the sun's rays.

ACULEATE. Furnished with prickles.

ACULEATES. The insects of the bee and wasp kind, furnished with stings.

ACUMINATE. Tapering to a point.

ADDUCTORS. Those muscles which draw the parts to which they are attached together: they are opposed to the abductors.

ADEPS. Lard.

ADIANTUM. A genus of elegant ferns: the fructification is in short marginal lines.

ADIPOSE. Fatty, as the adipose tissues.

ADNATE. Adhering, growing, or attached to the surface.

ADVENTITIOUS. Occurring in an unusual manner, as when a bud arises from the root of a plant.

ADULARIA. A brilliant crystalline feldspar.

AERATING. Introducing air or gases.

ÆSTIVATION. The manner in which the parts of the flower bud are folded together.

ÆTHEOGAMOUS PLANTS. The cryptogamia.

AETHER. See *Ether*.

AETIOLOGY. The study of the causes of disease.

AFFINITY. In natural history, the close resemblance of animals or plants in their organization.

AFFINITY. In chemistry, the force which combines dissimilar bodies together in precise proportions. See *Atom*.

AFTER-GRASS. The second crop of grass from lands mowed the same year.

AFTER-MATH. The second mowing of permanent meadows the same year. It is free from flower stems, and often much more nutritious than the first crop; but it is customary to feed it off by sheep or cattle instead of cutting.

AGAMOUS. Cryptogamic plants.

AGARICUS. A genus of mushrooms distinguished by plaits or gills under the cap, which are arranged nearly parallel. Several are nutritious and of a delicate flavour, as *A. campestris* (the common mushroom), *chan-*

tarellus, deliciosus, cinnamomeus, pratensis, violaceus. The poisonous kinds have usually a narcotic or acrid odour.

AGAVE. The Mexican aloe. The juice yields pulque, and a good hemp is made from the leaves.

AGE OF ANIMALS. For that of the horse, see *Horse.*

Age of Neat Cattle.—The age of *cows, oxen,* and *bulls* is known by the teeth and horns. At the end of about two years they shed their first fore-teeth, which are replaced by others, larger, but not so white; and before five years all the incisive teeth are renewed. These teeth are at first equal, long, and pretty white; but as the animals advance in years, they wear down, become unequal, and black. When three years old, neat cattle also experience a considerable change in the structure of their horns, after which period these appendages, like the second or permanent teeth, preserve the same character. During the first year of the animal's age, two small, smooth, pointed, and neatly-formed horns make their appearance, attached to the head by a kind of button. This conformation continues during the first three years, after which the button moves from the head, being impelled by a horny cylinder. Thus the horns continue growing as long as the animal lives, as is indicated by the annual joints, which are easily distinguished in the horn, and by which the age of the creature may be easily known, counting three years for the point of the horn, and one for each of the joints or rings. Dishonest dealers sometimes obliterate these rings by shaving or filing the horns, in order to conceal the age of the beast.—(*Johnson.*)

Age of Sheep.—The age of these animals is known by their having, in their second year, two broad teeth; in their third year, four broad teeth; in their fourth year, six broad teeth; and in their fifth year, eight broad teeth before; after which none can tell how old a sheep is while its teeth remain, except by their being worn down.

About the end of one year, rams, wethers, and all young sheep lose the two fore-teeth of the lower jaw; and they are known to want the incisive teeth in the upper jaw. At eighteen months, the two teeth joining to the former also fall out; and at three years, being all replaced, they are even and pretty white; but as these animals advance in age, the teeth become loose, blunt, and afterward black.

AGI, or AGY. Chilian pepper, *Capsicum baccatum.*

AGISTMENT. Payment for pasturage on another's lands.

AGRICULTURE. The whole art and science of husbandry. For the history, see *Loudon's Encyclopædia of Agriculture.*

AGRIMONY. The genus *Agrimonia,* perennial, unimportant weeds of small size.

AGRIONIDÆ. The family of insects called dragon flies (Libellula, Agrion).

AGRONOMY. The cultivation of land, agriculture.

AGROSTIS. The genus of *bent grasses.* They grow chiefly in wet places, and flower late; most are perennial, stoloniferous, or creeping, and are therefore difficult to extirpate, and unsuited to rotations. The *Agrostes stricta* is the red top, or herd grass. *A. stolonifera* is Richardson's fiorin, and, when grown in rich, wet pastures, is very superior.

AIGRETTE. The down or pappus of the seeds of compositæ.

AIR. Any gas, but usually the *atmosphere,* which see.

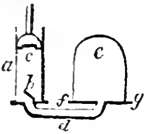
AIRA. The genus of *hair grasses.* They are perennial, usually grow in wet places, and are of little moment in agriculture.

AIR CELLS. In plants, enlarged cavities in the cellular tissue, to produce buoyancy in aquatic plants. In *birds,* membranous cavities communicating with the lungs, and traversing all parts of the bird, even to the interior of the bones and quills. In some insects the air vessels are enlarged into cells.

AIR PLANTS. Those which grow

without striking their roots into the soil. They usually derive sustenance from other plants.

AIR PUMP. A machine for removing the air out of a vessel. The principle of this important philosophical instrument is very simple, and may be easily comprehended from a brief explanation. The essential part of the machine consists of an exhausting syringe (*a*), formed of a tube or barrel of brass, closed at one end, with the exception of a small orifice, to which a valve (*b*), opening inward, is attached. An air-tight piston is worked up and down in the barrel by a rack and pinion turned by a winch. The piston has also an orifice with a valve (*c*), which opens upward, or in the same direction as the valve of the tube. The syringe communicates, by means of a small pipe (*d*) fitted into the opening at its lower extremity, with a vessel (*e*) called the receiver, from which the air is to be extracted.



The receiver is placed on a brass plate (*f*, *g*), over a small hole, into which the other end of the pipe is inserted; and, in order that the contact may be air-tight, the edge of the glass is previously rubbed with lard or some unctuous matter.

Suppose the piston at the bottom of the tube. As it begins to be drawn up, the valve *c* of the piston is immediately shut by the pressure of the exterior atmosphere, so that no air can enter the barrel, and a perfect vacuum would be left under it, were it not that the valve at the bottom of the barrel is forced open by the pressure of the air in the receiver, which rushes into the barrel till its density becomes the same both in the receiver and barrel. When the piston has been drawn to the top of the barrel, the whole of the air which occupied the barrel has been removed, and the receiver and barrel are now both filled with the air which was previously contained in the receiver alone.—(*Brande's Encyclopædia.*)

AIR VESSELS. Spiral vessels, tracheæ.

ALATE (from *ala, a wing*). With lateral expansions, winged.

ALBUMEN. One of the important azotized principles of animals and plants. In the solid state it constitutes the principal component of membranes, and in the fluid form is found in the serum of blood and the white of egg. The juice of all plants contains a small quantity. In the moist state it is readily putrescible, and coagulates at about 180° Fahrenheit; but when dry it is a transparent, brittle substance, which resists decay. For its composition, see *Protein.*

ALBUMEN, in botany, is the fleshy, mealy, or horny substance forming the substance of the seed, and lying between the embryo and testa.

ALBURNUM. The sap wood. The ascending sap rises along its pores. It is usually of a different colour, and much more perishable than the heart wood.

ALCOHOL. Spirit of wine. It is formed during the vinous fermentation. The pure spirit has a specific gravity of .792, and consists of $C_4 H_6 O_2$. It is present in brandy, whiskey, and strong spirits to the extent of fifty per cent., twenty-five per cent. in strong wines, ten per cent. in cider and ales, and six per cent. in beer. It is of great use in the laboratory as a solvent of resins, &c., and for the hot flame it produces when burned in lamps.

ALDER. Shrubs of the genus *Alnus*, which is closely allied to the birch. The common swamp alder is the *A. serrulata.* The *A. glauca* (black alder) is used by dyers for the production of a black.

ALE. A strong beer made from light malt.

ALE-HOOF. Ground ivy.

ALEMBIC. A retort with a moveable cover or cap.

ALEXANDERS. An umbelliferous plant, formerly cultivated like celery.

ALGÆ. The family of seaweeds and fresh-water weeds (*Con-*

ferva). They are cellular and cryptogamic.

ALIMENTARY CANAL. The passage from the mouth through the stomach and intestines.

ALITRUNCK, ALITRUNCUS. In entomology, the posterior segment of the thorax of an insect, to which the abdomen is affixed, and which bears the legs, properly so called, or the two posterior pairs, and the wings.

ALIZARINE. The red colouring principle of madder.

ALKALI, ALCALI. A term originally applied to the ashes of plants, now generally used to designate potash, soda, lithia, and ammonia, which are also termed vegetable, mineral, and volatile alkali. These substances have certain properties in common, such as neutralizing and forming salts with the acids, reddening several vegetable yellows, and changing some blues to green, and ready solubility in water. Lime, baryta, strontia, and magnesia have been called alkaline earths, from their analogous action on vegetable colours. Lithia is also one of the alkalis. A singular class of bodies have been discovered in vegetables, which have been termed alkalis, or alkaloids, chiefly in consequence of their power of saturating, and forming definite salts with the acids. Morphia, quinia, &c., are substances of this description.

ALKALIMETER. A graduated glass tube employed in determining the quantity of real alkali in commercial potash and soda, by the quantity of dilute sulphuric acid of a known strength which a certain weight of these saturates.

ALKANET. *Anchusa tinctoria.* The root of this plant, which is a native of the warmer parts of Europe, contains a red resinous colouring matter, which it imparts to alcohol and oils; it is used to tinge some ointments, especially lip-salves, of a red colour.

ALLANTOIS. A membrane attached to the extremity of the alimentary canal in the fetal calf and other animals. It contains the allantoic fluid.

ALLSPICE. The pimento.

ALLUVIUM, ALLUVION. A soil formed by the deposites of ancient rivers, or washed from hill-sides by floods. The character of the soil differs with the country through which the flood has passed; but it is always rich, because it contains matter finely divided, and much organic remains. It is not to be confounded with diluvium, which signifies an ancient gravel.

ALMOND. *Amygdalus argentea* and *nana.* The silver and dwarf almond ornamental shrubs.

ALMOND-TREE. *Amygdalus communis.* Varieties: bitter, sweet tender shell, sweet hard shell, long fruit, and peach-almond of large size. The tree is of small size, bears an abundance of flowers, and may be grown advantageously south of Maryland.

Propagation.—All the species and varieties are propagated by seeds, budding, grafting, layers, and occasionally they will produce suckers, which may be successfully planted out. When stocks for budding or grafting upon are wanted, or new varieties desired, these are obtained by sowing the fruit stones, though they may be budded or grafted on mussel-plum stocks.

The stones of the last season's produce should be sown in October, upon a bed of light, rich soil, about three inches apart, and covered four inches deep with fine soil. This is indispensable; for when the soil is left in lumps, the shoots are often forced into a crooked direction, and this causes the trunk to be deformed, and unfit to become a fine tree. When the surface of the seed-bed has been smoothed, a covering of rotten tanner's bark or leaf mould, to the depth of two inches, must be laid upon it, which being light, prevents the fruit-stones from being damaged by any severity of winter. At the beginning of May this covering of bark or leaves must be raked clean off the bed. The stones might be reserved till spring, and be sown at the end of

March, but the plants do not come so certainly as when sown in autumn. An additional advantage of an autumn sowing is, that the plants come up about six weeks or two months earlier than those sown in spring; consequently, the plants become vigorous and well rooted the first year, and thereby not liable to be thrown out of the ground by thaws succeeding frost in the following winter.

During summer, care must be taken to pull up all weeds when very young; for if they be allowed to get strong before pulling out, this operation is apt to injure the roots of the almond plants.

When almond stones have been sown in spring, it will be necessary, at the approach of the succeeding winter, to have the beds covered with rotten tanner's bark, or leaf mould, scattering it an inch deep or more among the plants: a covering which will tend to prevent the plants being injured or thrown out by frost.

In the second spring after the sowing, the plants should be taken up, carefully preserving all the fibrous roots: a care which, as they are but sparingly produced, will be essentially necessary. The plants must be transplanted in rows, two feet apart row from row, and a foot and a half distant in the rows. Here they may be trained to form standards, half standards, or dwarfs, and be regulated and prepared either for wall training or shrubbery plantations. For both purposes, attention will be requisite during summer and wniter to thin out the branches, reserving only a suitable number for the future limbs of the tree, and these so far apart that they may not, in any future stage of growth, be liable to rub against each other, which standard trees would be liable to; for if this be not avoided, gum would be exuded at such injured parts, and the speedy decay of the tree be the consequence.

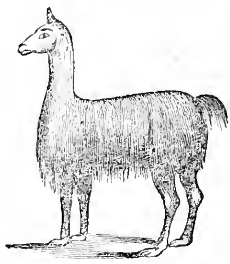
Almond plants intended for training against walls should have some stakes fixed in the form of a trellis, to which the branches should be secured in a proper form, so that they may be suited to the position of the wall on their final removal.—(*Miller's Dictionary.*)

ALOËS. The dried juice, or an extract of numerous species of *Aloe*, particularly the *Aloe spicata.* The plants inhabit arid countries in the tropics, and have long, rather fleshy leaves, and a liliaceous inflorescence arranged in spikes.

The drug is a nauseous, bitter, and warm purgative. It is administered to horses in balls of six to eight drachms.

ALOPECURUS. The genus of fox-tail grasses; they resemble the cat's-tail. Many are of great agricultural value. See *Grasses.*

ALPACA. The Llama, or Peruvian sheep. It is cultivated in the Andes of Peru for its long fleece, and as a beast of burden. The flesh is also good. These animals are of the



same family as the camel, and are extremely hardy and abstemious. Their wool is largely imported into England from Peru.

ALTERATIVES. Medicines which improve the health without any active effects.

ALTERNATE HUSBANDRY The system in which one part of the farm is in pasture and part arable; and these are changed every few years.

ALUDEL. An implement used in sublimation, and resembling an alembic.

ALUM. The sulphate of alumina and potash. The powder is a powerful styptic, and used to arrest bleeding. In lotion it is astringent and stimulating. When burned, the powder becomes caustic.

The *lotion* may be made with six to eight drachms of alum to a quart of water. It is used for grease, cracks in the heels of horses, and ulcers after the inflammation is subdued.

The alum is used by dyers, but the solution of acetate of alumina is superior for most purposes.

ALUMINA. Pure base of clay, argil. It is a sesquioxide of aluminium, white, insoluble; but it possesses a great affinity for water. In the crystalline state it forms the sapphire and emerald. It is a feeble base, uniting with acids. The hydrated silicate of alumina forms the bulk of clay.

ALUMINIUM. The metallic base of alumina.

ALVEOLATE. Covered with little pits; honey-combed.

ALVINE. Relating to the bowels.

AMALGAM. A compound of mercury with a metal.

AMANITA. A genus of poisonous mushrooms.

AMAUROSIS. Total blindness, without loss of brilliancy in the eye.

AMBLE. The same as the pace in horsemanship.

AMBUSTION. A scald or burn.

AMELIORATING CROPS. Root crops, clovers, and grasses, fed on the land.

AMENDMENTS. Sand, marl, and other substances applied in large quantities to amend the tilth.

AMENTUM. The catkin; a deciduous spike, such as that of willows, poplars, &c. Trees with this inflorescence are called amentaceous, and usually contain much potash in their ashes.

AMENTABOLIANS. Insects which do not undergo metamorphoses.

AMERICAN BLIGHT. The woolly or mealy aphis. *Aphis lanigera*, also called *Eriosoma mali:* it is very destructive to apple and pear trees in England. See *Insects*.

AMIDOGENE. A theoretical basis of ammonia, composed of $N H_2$: its compounds with metals are termed amides, or amidides.

AMIDINE. The soluble, internal portions of the starch globules.

AMMONIA. Volatile alakli, spirits of hartshorn. See *Nitrogen*.

AMMONIACAL GAS. The gaseous state of pure ammonia before it is dissolved by water, in which it is extremely soluble; it is also rapidly absorbed by charcoal, clays, rust, &c.

AMMONIUM. A hypothetic base of ammonia, consisting of $N H_4$. The oxide of ammonium is the common base, as found in the salts of ammonia, and consists of $N H_4 O$.

AMNION. The delicate membrane which surrounds the fetus in utero: it contains the amniotic fluid, or liquor amnios.

AMNIOS. The fluid within the nucleus of the young seed, on which the embryo feeds.

AMORPHOUS. Without regular figure or form.

AMPHIBOLE. A variety of hornblende.

AMPHITROPAL. In botany, an embryo which is turned round in the albumen, or curved upon itself in such a manner that both its ends are presented to the same point.

AMPLEXICAUL. Clasping or embracing the stem.

AMYGDALUS. The generic name of the peach and almond.

AMYGDALOID. Rocks in which other minerals are imbedded, puddingstone.

AMYGDALIN. A white, sweetish, soluble matter in bitter almonds, changeable into oil of bitter almonds by the action of emulsin.

AMYLACEOUS. Starchy, full of starch.

AMYLIN. Pure starch.

ANAL GLANDS. Glands for the secretion of various substances, situated near the anus.

ANALYSIS The separation of the components of any substance. It is *quantitative* when the amount of each ingredient is to be known, *qualitative* when the nature only.

Analysis of soils is of no value unless rigorously performed with perfect means. It is best, however, for agricultural purposes, to discover the presence or absence of a given substance, as lime or bone earth, rather than enter into the complete solution of the substance. The ordinary means of distinguishing the components of a soil is given under SOILS. The following, from Boussingault, is of a higher character:

In examining a soil, attention ought to be directed, 1st, to the sand; 2d, to the clay; 3d, to the humus which it contains. It would farther be useful to inquire particularly in regard to certain other principles which exert an unquestionable influence upon vegetation, such as certain alkaline and earthy salts.

Vegetable earth dried in the air until it becomes quite friable may nevertheless still retain a considerable quantity of water, and which can only be dissipated by the assistance of a somewhat high temperature. It is therefore proper, in the first instance, to bring all the soils which it is proposed to examine comparatively, to one constant degree of dryness. The best and quickest way of drying such a substance as a portion of soil, is to make use of the oil bath; a quantity of oil contained in a copper vessel is readily kept at an almost uniform temperature by means of a lamp. A thermometer plunged in the bath shows the degree to which it is heated: the substance to be dried is put into a glass tube of no great depth, and sufficiently wide; or into a porcelain or silver capsule, if the quantity to be operated upon be somewhat considerable: these tubes or vessels are placed in the oil so as to be immersed in it to about two thirds of their height. For the desiccation of soils, the temperature may be carried to 150° or 160° C. (334° or 352° F.). The weight of the vessel is first accurately taken, and a given weight of the matter to be dried is then thrown into it, after which it is exposed to the action of the bath. If we operate upon from 600 to 700 grains, the drying must be continued during two or three hours; the weight of the capsule with its contents, after having been wiped thoroughly clean, is then taken. It is placed anew in the bath, and its weight is taken a second time after an interval of fifteen or twenty minutes; if the weight has not diminished, it is a proof that the drying was complete at the time of the first trial. In the contrary case, the operation must be continued, and no drying must be held terminated until two consecutive weighings, made at an interval of from fifteen to twenty minutes, show anything more than a very trifling difference. Davy points out another and much more simple method, which, although far from accurate, may nevertheless suffice in many general trials. The soil to be dried is put into a porcelain capsule heated by a lamp, and a thermometer, with which the mass may be stirred, is placed in its middle, and shows the temperature at each moment. Lastly, in many circumstances the marine bath may suffice. In drying, the main point is to do so at a known temperature, and one which may be reproduced; for the absolute desiccation of a quantity of soil could not be accomplished except at a heat close upon redness, and this would, of course, alter or destroy the organic matters it contains.

The organic matters contained in ordinary soils consist in part of pieces of straw and of roots, which are usually separated by sifting the earth through a hair sieve; the gravel and stones which the soil contains are separated in the same way.

The earth sifted is now washed. To accomplish this, it is introduced into a matrass, with three or four times its bulk of hot distilled water; the whole is shaken well for a time, the matrass is left to stand for a moment, and then the liquid is decanted into a wide porcelain capsule. The washing is continued, fresh quantities of water being added each time, until the whole of the clay has been removed, which is known by the fluid becoming clear very speedily; the sand which remains is then washed out into another capsule. The argillaceous particles, or the clay and all the matters held in suspension in the water, are thrown upon a filter and dried; the desiccation is completed by the same process, and under the same circumstances as that of the soil had been. The sand is, in like manner, dried with the same care.

If we would ascertain the nature and quantity of the soluble salts, the whole of the water used in the washing must be put together and evaporated, which may be done upon a sand bath. The evaporation is pushed to dryness, and the salts that remain, having been previously weighed, are thrown into a small platinum capsule, in which they are heated to a dull red by means of a spirit-lamp, in order to burn out the organic salts, and thus distinguish, by means of a subsequent weighing, between them and the inorganic salts.

The sand may be silicious or calcareous. The presence of carbonate of lime is readily ascertained by treating it with an acid which will form a soluble salt with lime, such as hydrochloric, nitric, or acetic acid. Effervescence shows the presence of a carbonate, the quantity of which may be estimated by weighing the sand dry before and after its treatment with the acid, particular care being, of course, taken to wash the remaining sand well before setting it to dry. This, however, is an operation of little use; the great object is to ascertain the quantity of sandy matter. Had we a particular interest in ascertaining the presence and estimating the quantity of the earthy carbonates contained in a sample of soil, it would be advisable to make a special inquiry, inasmuch as the finely-divided calcareous earth being carried off along with the clay in the course of the washing, the sand obtained never contains the whole of the carbonate of lime.

The argillaceous matter procured by the washing is far from being pure clay; it contains a quantity of extremely fine sand, particles of calcareous earth, and if the soil contain humus, the more delicate particles of this substance will also be included.

To determine the quantity of humus, recourse is generally had to its destruction by heat. A known weight of dried earth is heated to redness in a capsule, and constantly stirred for a time, and when no more of those brilliant points or sparks, which are indications of the combustion of carbon, are observed, it is set to cool, and then weighed. This is the method which has been generally followed by Davy and others. It would be difficult to find a method more convenient than this, but it is, unfortunately, very inaccurate. Soils dried at a temperature at which organic matter, such as humus, &c., begins to change, still retain a considerable quantity of water in union with the clay. This water is disengaged at the red heat required for the combustion of the organic matters; and as their quantity is estimated by the loss of weight on the subsequent weighing, it is obvious that the loss from the dissipation of water is added to that which proceeds from the destruction of the humus. It is undoubtedly to this cause of error that we must ascribe the large proportions of humus mentioned in the soils examined by Thaer and Einhoff; it is therefore better to restrict the examination to the determination of the presence or absence of humus than to attempt to ascertain its quantity by so imperfect a method.

Priestley and Arthur Young were already aware that a more delicate operation was required to determine the quantity of humus. They recommend calcination of the soil in a close vessel, and that the gaseous products should be collected. This mode of proceeding, however, would have but slight advantages over that which I have just criticised, inasmuch as the volume of gas collected varies with every difference of heat employed.

The only method, in my opinion, which we have of learning the quantity of humus, of organic debris, which is contained in a soil, is that of an elementary analysis. It is by burning a known quantity of earth thoroughly dried by means of the oxyde of copper, aided by a current of oxygen, that the carbon and hydrogen may be determined. But the most important point of all is to ascertain the amount of azote included in the organic remains of the soil; and we have, happily, precise means in our elementary analysis of ascertaining the quantity of azote from which the amount of azotized organic matter may be accurately inferred.

It may be very useful to determine the presence or absence of *carbonate of lime* in a soil; this knowledge would, of course, guide us in our applications of lime, marl, &c. Two modes may be employed for this purpose; 1st, the soil may be treated by nitric acid slightly diluted with water. Any effervescence will denote the presence, in all probability, of carbonate of lime. I say in all probability, because the disengagement of carbonic acid gas under such circumstances generally indicates the presence of carbonate of lime; it is not, however, a special character, because the disengagement may be due to the presence of any other carbonate. It is well to boil the acid solution upon the sample of soil that is analyzed; the part which is not dissolved is thrown upon a filter and washed with distilled or rainwater boiling hot. Into the clear filtered liquor which results from all the portions of water used in the washing, a little ammonia is added; if any precipitate falls, it is collected upon a filter and washed: to the new liquors obtained by this washing, a solution of oxalate of ammonia is added. If there be any lime present, it is thrown down in the state of oxalate, and the liquor, having been left at rest for five or six hours, becomes completely clear; the addition of a few drops of the solution of oxalate of ammonia to this clear fluid satisfies us whether the whole of the lime has been precipitated or not. The oxalate of lime is received upon a filter, washed, and dried; it is then thrown into a platinum capsule along with the piece of filtering paper upon which it was collected, and is heated to a dull red, until the paper of the filter is completely consumed and no farther trace of carbon appears; the capsule is then taken from the fire, or from over the spirit lamp, and cooled; when cold, the matter which it contains is moistened with a concentrated solution ot carbonate of ammonia.

The matter is then dried, great care being taken that nothing is lost by particles flying out, and the capsule is again heated to a dull red; when cold, it is weighed accurately, and the quantity of matter contained then becomes known. This matter is carbonate of lime, 100 of which represents 56·3 of lime and 43·7 of carbonic acid. I have said that in arable soil other carbonates may be met with besides that of lime; calcareous soils, for example, very commonly contain carbonate of magnesia. If we would ascertain the quantity of this earth, the mode of proceeding which I have just particularly indicated enables us to do so; we have but to evaporate the liquid from which the oxalate of lime was deposited, and then to calcine the product of the evaporation in a platinum capsule. Any nitrate of magnesia which may exist there will be decomposed at a dull red heat, as well as any oxalate of ammonia which may have resulted from ammonia added in excess. By treating the residue of the calcination with water, we obtain the magnesia, which, being washed, has only to be calcined, and its weight ascertained by weighing.

2. If we would be content with a simple approximation, we may judge of the quantity of calcareous carbonate contained in a vegetable soil by measuring the quantity of carbonic acid which we obtain from it. We counterpoise upon the scale of a balance a vial containing some diluted nitric acid; we weigh a certain quantity of the earth to be analyzed, and this is added by degrees to the acid. If the earth contains carbonates, effervescence ensues. The liquid is shaken with care, and having waited

a few minutes in order to let the carbonic acid which is mixed with the air of the vial escape, the vial with its contents is again put into the balance. If there has been no disengagement of carbonic acid, it is clear that, to restore the equilibrium, it will be sufficient to add to the opposite scale the weight of the earth which was put into the vial; whatever is wanting of this weight represents precisely the weight of carbonic acid which has been disengaged. Presuming this acid to have been combined with lime, the weight of the calcareous carbonate can be calculated exactly.

Sulphate of lime is an occasional constituent of soils; to ascertain its presence and quantity, the following is the method of procedure:

The earth, well pulverized, is first roasted for a considerable time in a crucible or platinum capsule until all the organic matter is completely destroyed; it is advisable to operate on about 100 grammes, or about 3·2 ounces troy of soil. After this operation, the matter is boiled in four or five times its weight of distilled water for some time, water being added to replace that which is dissipated by evaporation; we then filter, rewash, and having added all the liquors, we evaporate in a capsule until the volume of the liquid is reduced to a few drachms. To the liquid thus concentrated we add its own bulk of alcohol. If the solution contains sulphate of lime, it will be deposited, and the deposite being received upon a filter and washed with weak alcohol, its weight is taken after having been dried and calcined. This salt is frequently seen deposited in the form of fine colourless needles on the cooling of the sufficiently concentrated solution; but the addition of alcohol is always useful, because the sulphate of lime, which is not very soluble in water, is altogether insoluble in weak spirits, which, on the contrary, dissolves certain alkaline and earthy salts whose presence would interfere with the accuracy of the result.

It may be matter of great moment to determine the existence and the quantity of *phosphates* contained in a soil destined for cultivation. Although the search for phosphoric acid may perhaps require a certain familiarity with chemical analysis, I shall nevertheless indicate the method of procedure. It is much to be desired that enlightened agriculturists should not remain strangers to manipulations of this kind.

The soil to be analyzed must be deprived of all organic matters by calcination. After having reduced it to a very fine powder, it is to be boiled for about an hour with three or four times its weight of nitric or hydrochloric acid. The solution is then diluted with distilled water, and filtered; the matter which remains upon the filter is generally silica or alumina which has escaped the action of the acid. After having reduced the washings by evaporation, and added them to the acid liquor, ammonia in solution is poured in. Taking the simplest instance, the precipitate which falls upon the addition of this alkali may contain, 1st, phosphoric acid in union with the peroxide of iron and lime; 2d, oxide of iron and of manganese; 3d, silica. This precipitate, which is usually of a gelatinous appearance, is received upon a filter, well washed and dried, when the precipitate is readily detached from the filter. It is thrown into a platinum capsule which is raised to a white heat, after which the weight of the residue is taken. The precipitate after calcination is thrown into a small glass matrass, and dissolved by hot hydrochloric acid. If there is any silica undissolved, its quantity is merely estimated if it be very small; if it be a larger quantity, it is to be collected upon a filter and weighed. To the new acid solution about three times its weight of alcohol is added; the mixture is shaken, and pure sulphuric acid is then instilled drop by drop until there is no longer any precipitate. The precipitate is sulphate of lime, which is thrown upon a filter, where it is washed with diluted alcohol; it is then dried, calcined, and the weight of the sulphate of lime obtained permits us to calculate that of the lime which formed part of the precipitate thrown down by the ammonia in the first instance. 100 of sulphate of lime are equivalent to 41·5 of pure lime.

The alcoholic liquor is concentrated in order to expel the spirit; as it is acid, it is saturated with ammonia until a slight precipitate begins to be formed, which is not redissolved upon shaking the mixture. A few drops of the hydrosulphate of ammonia are then added, upon which the iron and the manganese fall in the state of sulphurets. As a part of the metals has been precipitated in the state of oxide by the ammonia added in the hydrosulphate, it is well to digest for eight or ten hours, because the hydrosulphate of ammonia always ends by changing the metals present into sulphurets, which being washed, dried, and reduced to the state of oxides by calcination in a platinum capsule, are weighed.

If the first ammoniacal precipitate did not contain phosphoric acid, its weight ought to be reproduced by adding that of the lime to that of the metallic oxides proceeding from the calcination of the sulphurets. Any loss which is noted after this, is due, if the process has been well conducted, to phosphoric acid, which had not been collected, but which has remained in the state of phosphate of ammonia in the liquid treated by the hydrosulphate. To determine with precision the presence of phosphoric acid, the liquid in question must be evaporated to dryness, and the residue heated strongly in a platinum capsule. After the dissipation and decomposition of the ammoniacal salts, there remains watery phosphoric acid, distinguishable by its powerful acid reaction, its sirupy consistence, and its fixity.

By way of example, I shall give the results obtained in an analysis of this kind:

From the acid liquor, ammonia threw down of:	grs. troy.
Phosphates and metallic oxides	8·012
These gave of sulphate of lime	8·768
Equivalent to lime	3·612
Hydrosulphate of ammonia caused a precipitate, which, calcined, gave of metallic oxides	1·620
Lime and metallic oxides together	5·233
Difference due to phosphoric acid	2·789

The analysis for phosphoric acid may be simplified by employing a process conceived by M. Berthier, and which is founded upon the strong affinity of this acid for the peroxide of iron, and the insolubility of the phosphate of the peroxide of iron in dilute acetic acid. If to a fluid containing at once phosphoric acid, lime, peroxide of iron, alumina, and magnesia in solution, ammonia be added, the precipitate will contain the whole of the phosphoric acid. The acid will be in great part combined in the state of phosphate of iron, if the peroxide of iron be in quantity more than sufficient to neutralize it: a condition which must be frequently expected in an arable soil; however, to make sure of this point, it is well to add a certain quantity of the peroxide of iron to the soil which is to be analyzed. Besides the phosphate of iron, the precipitate may contain phosphate of lime, phosphate of alumina, and certainly ammoniacal magnesian phosphate. Finally, with these phosphates will be found associated alumina and oxide of iron, the latter especially, if it has been introduced in excess. The precipitate, collected upon a filter and washed, must then be treated with dilute acetic acid, which will dissolve the lime, the magnesia, and the excess of the oxides of iron and alumina; and there will remain phosphate of iron or phosphate of alumina, because the latter salt is as insoluble as the former in acetic acid. Whenever the precipitate in question, therefore, leaves a residue which is insoluble in vinegar, the presence of phosphoric acid may be inferred; this residue may consist of basic phosphates of iron or alumina, or of a mixture of the two salts, and no great error will be committed if one hundred parts of this residue, calcined, be assumed as representing fifty of phosphoric acid.

The presence of silica in the precipitate insoluble in acetic acid may, however, lead to error. To make sure that the precipitate is formed by a phosphate, it must be redissolved in hydrochloric acid, and the acid solution evaporated to dryness, so as to render the silica which may exist in it insoluble. By treating the residue with hydrochloric acid again, the phosphates alone will be dissolved. The presence of phosphoric acid may otherwise be determined by treating the phosphate of iron in solution in the way which I have already indicated.

From what precedes, it must be obvious that the most carefully conducted chemical analysis of a soil only leads us to the discovery of certain principles which exist in very small quantity, although their action is unquestionably useful to vegetation. As to the determination of the relative quantities of sand and loam, this rests upon simple washing; and a chemist would spend his time to very little purpose in seeking, by means of elementary analyses, to determine the precise composition of these substances. The finest part, carried off by the water, will always show properties analogous to those of clay; the sand, which is generally silicious, will exhibit the characters of quartz; and the calcareous fragments which are mixed with it will exhibit those that belong to carbonate of lime. It will be sufficient, then, in connexion with the mineral constitution of arable soils, to expose very briefly the general properties of clay or loam, of quartz, and of carbonate of lime, substances, in fact, which form the bases of all arable lands. Pure *clay*, composed of silica, alumina, and water, does not contain these substances in the state of simple mixture. The inquiries of M. Berthier have satisfactorily shown that clay is a hydrated silicate of alumina. When we remove a portion of the alumina from clay, for example, by treating it with a strong acid, the silica which is set at liberty will dissolve in an alkaline solution, which would not be the case were the silica present in the state of quartzy sand, however fine.

Pure clays are white, unctuous to the touch, stick to the tongue when dry, and when breathed upon, give out an odour which is well known, and is commonly spoken of as the argillaceous odour. This property of dry clay to adhere to the tongue is owing to its avidity for water. It is known, in fact, that dry clay, brought into contact with water, first swells, and finally mixes with it completely. Duly moistened, it forms a tough and eminently plastic mass. Exposed to the air, moist clay, as it dries, shrinks considerably; and if the drying be rapid, the mass cracks in all directions. It is to an action of this kind that we must ascribe the cracks and deep fissures which traverse our clayey soils in all directions during the continuance of great droughts.

The constitutional water of clays is retained by a very powerful affinity, and does not separate under a red heat; pure clay has a specific gravity of about 2·5; but the weight is frequently modified by the presence of foreign matter, for it contains sand, metallic oxides, carbonate of lime, carbonate of magnesia, and frequently even combustible substances, from bitumen to plumbago, all of which admixtures of course modify the properties which are most highly esteemed in clays, such as fineness, whiteness, infusibility, &c.

Quartz is abundantly distributed throughout nature, and is met with in very different states: in the form of transparent colourless crystals, constituting rock crystals, as sand of different fineness; finally, in masses, constituting true rocks. Quartz is the silica of chemists, and a compound, according to them, of oxygen and silicon, in the proportion, Berzelius says, of 100 of the radical to 108 of oxygen.

Silica, in a state of purity, occurs in the form of a white powder, and having a density of 2·7. It is infusible in the most violent furnace; but it not only melts in the intense heat which results from the combustion of a mixture of hydrogen and oxygen gas, but it is even dissipated in vapour. As generally obtained, silica is held insoluble in water; still, when in a state of extreme subdivision, it is soluble; and then its insolubility is probably not so absolute as is generally supposed, for M. Payen has found notable quantities in the water of the Artesian well of Grenelle, and in that of the Seine. Silica exists especially, in very appreciable quantity, in certain hot springs, where the presence of an alkaline substance favours its solution; the water of the hot springs of Reikum in Iceland contain about $\frac{4}{1000}$th parts of its weight of silica; and the thermal spring of Las Trincheras, near Puerto Cabello, deposites abundant silicious concretions. The water of this latter spring, which is at the temperature of 210° Fahrenheit, besides silica, contains a quantity of sulphureted hydrogen gas, and traces of nitrogen gas. Rock crystal, when colourless and transparent, may be regarded as pure silica; in the varieties of quartz which mineralogists designate as chalcedony, agate, opal, &c., the silica is combined with different mineral substances, particularly oxide of iron and of manganese, alumina, lime, and water.

Carbonate of Lime, considered as rock, belongs to every epoch in the geological series, and frequently constitutes extensive masses. When pure, it is composed of lime, 56·3; carbonic acid, 43·7; and its density is then from 2·7 to 2·9. It dissolves with effervescence, without leaving any residue in hydrochloric or nitric acid. Exposed to a red heat, its acid is disengaged, and quick-lime remains. Carbonate of lime is insoluble in water, but it dissolves in very considerable quantity under the influence of carbonic acid gas. When such a solution is exposed to the air, the acid escapes by degrees, and the carbonate is deposited, by which means those numerous deposites of carbonate of lime are produced which we see constituting tufas and stalactites. The solubility of carbonate of lime in water acidulated with carbonic acid enables us to understand how plants should meet with this salt in the soil, inasmuch as rainwater always contains a little carbonic acid.

The mineral substances which we have now studied, taken isolatedly, would form an almost barren soil; but, by mixing them with discretion, a soil would be obtained presenting all the essential conditions of fertility, which depend, as it would seem, much less on the chemical constitution of the elements of the soil than on their physical properties, such as their faculty of imbibition, their density, their power of conducting heat, &c. It is unquestionably by studying these various properties that we come to form a precise idea of the causes which secure or exclude the qualities we require in arable soils This has been done very ably by M Schübler; and his admirable paper will remain a model of one application of the sciences to agriculture.*

The researches of M. Schubler were directed to the mineral substances which are generally found in soils, viz.: 1st. Silicious sand; 2d. Calcareous sand; 3d. A sandy clay containing about $\frac{4}{10}$ths of sand; 4th. A strong clay containing no more than about $\frac{2}{10}$ths of sand; 5th. A still stronger clay containing no more than about $\frac{1}{10}$th of sand; 6th. Nearly pure clay; 7th. Chalk, or carbonate of lime in the pulverulent state; 8th. Humus; 9th. Gypsum; 10th. Light garden earth, black, friable, and fertile, and containing, in 100 parts, clay 52·4, quartzy sand 36·5, calcareous sand 1·8, calcareous earth 2·0, humus 7·3; 11th. An arable soil composed of clay 51·2, silicious sand 42·7, calcareous sand 0·4, calcareous earth 2·3, humus 3·4; and, 12th. An arable soil taken from a valley near the Jura, containing clay 33·3, silicious sand 63·0, calcareous sand 1·2, calcareous earth and humus 1·2, loss 1·3.

The object of these inquiries was to ascertain, 1st. The specific gravity of soils; 2d. Their power of retaining water; 3d. Their consistency; 4th. Their aptitude to dry;

* Schübler, Annals of French Agriculture, vol. xl., p. 122, 2d series.

5th. Their disposition to contract while drying; 6th. Their hygrometric force; 7th. Their power of absorbing oxygen; 8th. Their faculty of retaining heat; and, 9th. Their capacity to acquire temperature when exposed to the sun's rays.

Specific Gravity of Soils. — The weight of soils may be compared in the dry and pulverulent state, or in the humid state; or the specific gravity of the particles which enter into their composition may be determined. This last information is easily obtained by the following method: Take a common ground stopper bottle; weigh it, stoppered and full of distilled water; let it then be emptied, in order that a known quantity of the soil, in the state of powder and quite dry, may be introduced into it. A quantity of water is now poured in, and the vial is shaken to secure the disengagement of all air bubbles; the vial is then filled with distilled water, and, when the upper part has become clear, the stopper is replaced; the vial is then wiped dry and weighed again. The difference between the weight of the vial full of water plus that of the matter, and the weight of the vial containing the matter and the water mixed, gives the weight of the water displaced by this matter. Thus:

Weight of the vial full of water . . .	60·0
Weight of the matter	24·0
	84·0
Weight of the vial containing the mingled earth and water	74·4
Difference of water displaced	9·6

which is the weight of the volume of water equal to that of the matter introduced into the vial; we have, consequently, for the specific gravity of the earth $\frac{24}{9\cdot6} = 2\cdot5$, the weight of the water having been taken as 1.

This number represents the mean specific gravity of the isolated particles of the powder which has been examined; but we must not, from this density, pretend to deduce the weight of a particular volume of soil —a cubic foot or a cubic yard, for instance: we should come to far too high a number. The weight of a given volume of earth must be determined immediately by ramming it into a mould or measure of a known capacity.

From M. Schübler's experiments it appears, 1st. That silicious and calcareous sandy soils are the heaviest of any; 2d. That clayey soils are of least density; 3d. That humus or mould is of much lower density than clay; 4th. That a compound soil being generally by so much the heavier as it contains a larger proportion of sand, and so much the lighter as it contains a larger quantity of clay, of calcareous earth, and of humus, it is possible, from the density of a soil, to infer the nature of the principles which prevail in it. In the course of his experiments, M. Schübler found that artificial mixtures always gave higher densities than those that ought to have resulted from the several densities of each of the sorts of substance which formed the mixture.

ANASARCA. A dropsy in the cellular tissue of the limbs.

ANASTOMOSING. Growing together, uniting.

ANASTOMOSIS. The interlacing and union of small veins or arteries proceeding from different parts.

ANATROPOUS. A very common kind of embryo, produced by one side of the ovule growing upon itself, while the other remains immoveable, till, at last, that part of the ovule which was originally next the apex is brought down to the hilum, the base of the nucleus in such cases being at the apex of the ovule. The common apple, and the greater part of plants, offer an example of this.

ANBURY. In farriery, a spongy, soft tumour, commonly full of blood, growing on any part of an animal's body. Substances of this kind may be removed either by means of ligatures being passed round their bases, or by the knife, and the subsequent application of some caustic, in order to effectually destroy the parts from which they arise.

ANBURY, *Ambury, Club-root: fingers and toes.* A swelling formed on the roots and ground-stems of cabbages, radishes, turnips, &c., by the maggot of a weevil.

The maggot found in the turnip anbury is the larva of *Curculio pleurostigma* of Marsham, and *Rhynchænus sulcicollis* of Gyllenhal. "I have bred this species of weevil," says Mr. Kirby, "from the knob-like galls on turnips, called the anbury, and I have little doubt that the same insects, or a species allied to them, cause the clubbing of the roots of cabbages." Marsham describes the parent as a coleopterous insect of a dusky, black colour, with the breast spotted with white, and the length of the body one line and two thirds.

The general experience of farmers and gardeners upon the subject testifies that the anbury of the turnip and cabbage usually attacks these crops when grown for successive years on the same soil. This is precisely what might be expected; for the parent insect always deposites her eggs in those situations where her progeny will find their appropriate food; and in the fragments of the roots, &c., of preceding crops, some of these embryo ravagers are to be expected. That they never attack the plants upon a fresh site is not asserted: Mr. Marshall's statement is evidence to the contrary. But it is advanced that the obnoxious weevil is most frequently to be observed in soils where the turnip or cabbage has recently and repeatedly been cultivated. Another general result of experience is, that the anbury is most frequently observed in dry seasons. This is also what might be anticipated, for insects that inhabit the earth just beneath its surface are always restricted and checked in their movements by its abounding in moisture. Moreover, the plants actually affected by the anbury are more able to contend against the injury inflicted by copious supply. In wet periods, also, the affected plants show less the extent of the injury they have sustained, for their foliage does not flag.

In considering the best modes of preventing the occurrence of the disease and of palliating its attacks, it is apparent that any addition to the soil that renders it disagreeable to the weevil will prevent the visits of this insect. The gardener has this in his power with but little difficulty, for he can keep the vicinity of his cabbage, cauliflower, and broccoli plants sprinkled with soot, powdered tobacco, or other offensive matters.

ANCHUSA. See *Alkanet*.

ANCHYLOSIS. A stiff, immoveable joint.

ANCIPITOUS. Having two edges.

ANDES GRASS. *Avena elatior.* Tall meadow oat; a perennial grass; flowers in May, and ripens its seeds in July. It is hardy, early, and makes good hay. It is difficult to root out, and lasts a long time. A clay loam is the best soil. Sow two and a half to three bushels with oats.

ANDROCEUM. The male parts of the flower.

ANDROGYNOUS. Hermaphrodite: a union of both sexes.

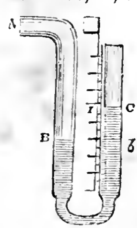
ANDROPORUM. An elevation in the middle of a flower, formed in part by the union of the filaments of the stamens.

ANELLIDES, ANELLATA. The class of articulated animals formed of ring-like segments, as the earthworms.

ANELYTROUS. Without elytra or wing cases.

ANEMOMETER. (Gr. *ἀνεμος, the wind*, and *μετρον, measure.*) An instrument for measuring the force or velocity of the wind; a wind gauge.

Dr. Lind's anemometer consists of a glass tube, bent into the form of the letter U, and open at both extremities. One of the extremities, A, is also bent round to the horizontal direction, in order that the wind may blow into it. The tube being partially filled with water and exposed to a current of air, the water in the branch at which the wind enters is depressed; for example, to B, and consequently ri-



ses in the other branch to C; and the difference at C, of the levels at which it stands in the two branches, is the height of a column of water, the weight of which forms a counterpoise to the force of the wind. The relative velocities of the wind are thus ascertained, the variation of the velocity being nearly proportional to the square root of the resistance. The bore of the tube is diminished at the bottom to check the undulations of the water caused by a sudden gust of wind. Various other contrivances have been proposed, of which one of the simplest is to expose a flat board of given dimensions to a current of wind, and observe to what extent it will force back a spring attached to it, and resting against an immoveable obstacle.—(*Brande.*)

ANEMOSCOPE. An instrument showing the direction of the wind; a weathercock.

ANEURISM. In farriery, a throbbing tumour, produced by the dilatation of the coats of an artery in some part of the body of an animal Aneurisms in the limbs may be cured by making an incision, exposing the artery, and tying it above and below the tumour with a proper ligature.

ANGINA. In farriery, a name sometimes applied to the quinsy, or what in animals is termed anticor; sore throat.

ANGIOSPERMOUS. Having the seeds enclosed within a covering or pericarp.

ANGLE BERRY. In farriery, a sort of fleshy excrescence, to which cattle and some other animals are subject under different circumstances, and are supposed to proceed from a rupture of the cutaneous vessels, which give vent to a matter capable of forming a *sarcoma*, or fleshy excrescence. They frequently appear upon the belly and adjacent parts, hanging down in a pendulous manner.

ANGUSTATE. Narrow, diminishing rapidly in breadth.

ANGUSTURA BARK. The bark of the *Cusparia febrifuga* of South America: used as a tonic.

ANHYDRITE. Anhydrous gypsum.

ANHYDROUS. Without water; a chemical term to express the entire absence of water in a salt or acid substance.

ANIMAL. Any object capable of voluntary motion; a function dependant on the nervous system, which is peculiar to animals and absent in plants.

ANIMAL ACIDS. Acids existing in animals, or produced from their tissues. The principal are the oily acids, choleic, lactic, and uric, which see.

ANIMALCULES. Infusorials.

ANIMAL MANURES. See *Urine, Manure.*

ANIMAL POISONS. The bites of venomous reptiles, rabid dogs, the contagious diseases produced by decaying meat, cheese, infected cattle, glanders, are all called animal poisons. They usually produce great prostration, and call for the use of ammonia and stimulants.

ANIONS. See *Electrode.*

ANISE SEED. *Pimpinella anisum.* The aromatic seeds of a well-known umbelliferous plant. The oil is a grateful aromatic to the stomach.

ANISOTOMIDÆ. A family of coleopterous insects, having moniliform or beaded antennæ, sub-elongate, slender at the base, gradually increasing towards the apex, with a terminal club-shaped multiarticulate joint; palpi various, generally filiform; head small and ovate; body convex, never linear.

ANKER. A small wine barrel of 10 gallons, or 8½ imperial measure.

ANNOTTA, ARNOTTA. *Roucon.* A red dye, obtained by fermenting the pulp of the seeds of the *Bixa orellana*, a tree of the West Indies. In the dairy a colouring matter is used under this name, which is manufactured from madder or carrots.

ANNUALS. Plants which perfect seeds in one year and die, as wheat, rye, &c.

ANNULUS. An organ resembling a ring, as the collar which surrounds the stem of some mushrooms.

ANODE. The way by which electricity enters substances through which it passes: opposed to cathode, the road or way by which it goes out.

ANODYNE. A drug which allays pain, as opium, camphor, henbane, &c.

ANONA. The custard apple-trees. The cherimoyer is of this genus.

ANTACIDS. Medicines which neutralize the acid of the stomach in disease, as chalk, carbonate of soda.

ANTENNA, ANTENNÆ. The hair-like, jointed organs on the heads of insects. They are very moveable, and are supposed to be organs of sensation.

ANTEPECTUS. In insects, the under side of the main trunk. in which the first pair of legs is inserted

ANTS. The family *Formicidæ*, hymenopterous insects. They are injurious to meadows by their hills, and also devour fruits. The anthill is readily destroyed by digging it up in the depth of winter and scattering the earth ; the exposure will thus destroy the entire colony.

ANTHELMINTICS. Drugs which are used to destroy intestinal worms. Turpentine, wormseed oil, pink-root, and aloes are the most important.

ANTHER. The bilobate organ, containing pollen, situated at the summit of the filament, the two constituting the male organ, or stamen of plants.

ANTHODIUM. A head of flowers, as in the thistle or sunflower: a capitulum.

ANTHOZANTHUM. A genus of grasses, of which *A. odoratum* is the sweet-scented vernal grass. See *Grasses*. It is an annual, and of little importance.

ANTIBRACHIUM. The forearm.

ANTICLINAL AXIS. The line lying between strata which dip in opposite directions.

ANTICOR. An inflammation of the throat and gullet in horses, attended with fever and prostration ; a kind of quinsy.

ANTIDOTE. A remedy against a poison.

ANTIMONY. The sulphuret ; a black metallic drug, used in the diseases of cattle as an alterative in skin diseases. An ounce is given to a horse.

ANTIMONY TARTRATE. See *Tartar Emetic*.

ANTIPHLOGISTIC. Remedies opposed to an inflammatory state.

ANTISEPTICS. Substances which prevent putrefaction.

ANTISPASMODICS. Remedies which cure spasms or cramps, as opium, camphor, asafœtida, &c.

ANTITROPAL. When in a seed the radicle of the embryo is turned to the end farthest away from the hilum. This, although a comparatively unusual position of parts, is nevertheless the normal position, if the exact nature of the development of an ovule is rightly understood.

ANTRUM. A cavity.

AORTA. The great arterial vessel which issues from the left ventricle of the heart, and by its branches distributes blood to every part of the body.

APATITE. A greenish, crystalline mineral found in primary rocks, consisting of a phosphate and silicate of lime. It is found in the Eastern and Northern States, but only in small quantities. In Spain and Norway large quantities are developed. It has been spoken of as a manure in the place of bones.

APERIENTS. Gentle purgatives.

APETALOUS. Without corolla.

APEX. The summit.

APHANIPTERA. An order of apterous insects, with rudimentary elytra, and undergoing a change of form. The flea (*Pulex irritans*) is of this kind.

APHIS, APHIDES (pl.). A family of hemipterous insects, commonly called "plant-lice," inhabiting trees and plants, and living on their juices ; remarkable for the anal saccharine secretion, but more especially for a peculiarity of their generative economy, particularly described by Bonnet, and which consists in the first fecundation of the female influencing not merely the ova immediately developed thereafter, but those of the females resulting from that development, even to the ninth generation, which are successively impregnated and productive without any intercourse with the male insects. Certain coleopterous insects which prey upon and keep in check the aphides, are termed aphidiphagi and aphidivora (φαγω, *I eat*, voro, *I devour*). For a figure, see *Insects*. Aphides are very numerous in species, most plants having a different kind. They are readily destroyed by fumigations with tobacco, Cayenne pepper, or sulphur, a solution of whale-oil soap, or water-slacked lime sprinkled upon them.

APHYLLUS. Leafless, without fully-developed green leaves.

APIARY. A bee-house.

APIS. The generic name of the bee.

APOCARPOUS. When the carpels of a fruit do not adhere together.

APOCRENIC ACID. See *Humus*.

APOPLEXY. The staggers. See *Horse*, *Sheep*, *Ox*.

APOPHYSIS. A protuberance, process, or projection. In anatomy, restricted to processes of the osseous system.

APOSEPADINE. A white crystalline body obtained from decayed cheese.

APOTHECIUM. The shield of lichens.

APPETITE. Want of appetite and voracious appetite are important symptoms in the diseases of horses and cattle; exercise, change of stable, ventilation, and a new kind of food and gentle purgation should be tried for the first; the second may arise from worms, and should be investigated.

APPLE. The cultivated fruit of the *Pyrus malus*, or crab; the tree belongs to the natural family *Rosaceæ*. The apple, like most other hardy trees, may be propagated by seeds, cuttings, suckers, layers, or ingrafting; by seeds for obtaining new varieties, and by the other modes for extending the number of such as are in esteem.

The following kinds are of different values, but ripen at different times, and represent the best set in cultivation.

Summer Apples, ripening from July to September:

Early Harvest, *Prince's Yellow Harvest, July Pippin*.—Fruit medium size; bright straw colour; flavour fine: ripe in July and August

Early Red Juneating, *Red Margarette, Strawberry*.—Rather small; very rich and fine: ripe in August.

Summer Queen, *Early Queen*.—Fruit large and oblong; striped with red on a yellow ground; high flavoured and fine: ripe in August.

Summer Pearmain, *American Summer Pearmain, Early Summer Pearmain*.—Too well known to need any description: ripe in August.

Williams Apple.—A beautiful fruit, of medium size and oblong form; colour deep red; flavour lively and very pleasant. First of August. A native of Roxbury, Massachusetts.

Maiden's Blush.—One of the handsomest fruits in the country. Size large, roundish shape; skin pale greenish-yellow, tinged with a blush; excellent for table use, drying, or cooking: ripe in August and September.

Autumn Apples.

Porter Apple.—Fruit large; oblong shape; skin bright yellow, with a red blush: ripe in October, and commands the highest price in the Boston market.

Fall Pippin, *Golden Pippin, Holland Pippin, Colbert's Fall Pippin, Vandine*.—Of all fall apples, this stands at the head of the list. Fruit large, and of a roundish oblong form; skin smooth and yellowish green, tinged with orange; flesh tender, with rich juice: ripe in October, and keeps till January and February.

Seek-no-farther, *Rambo*, or *Romanite*.—This fruit is much cultivated about Philadelphia. Shape flat, resembling the Vanderveere, but is a better fruit; skin pale yellow, streaked with red; flesh tender and sprightly during the fall: is both a fall and winter apple.

Stroat, *Straut.*—A fine fall apple, introduced by the late Judge Buel, of Albany: in use from September to December.

Winter and Spring Apples.

Esopus Spitzenburg.—Fruit large and oval shape; colour red, covered with light yellow spots; flesh of the finest flavour for dessert or cooking, and keeps till February.

Baldwin, *Baldwin Pippin.*—In the Boston market this fruit has long brought the highest prices. Colour bright red, tinged with yellow; flesh juicy, rich, sweet, and most agreeable flavour: ripe in November, and keeps till March.

Bell-flower.—A beautiful fruit, long celebrated about Philadelphia as their finest winter fruit: ripe in October, and keeps till March.

Blue Pearmain.—A well-known fruit about Boston. Large size; colour red, covered with a blue bloom; flavour delicious, and keeps till January.

Hubbardston Nonesuch.—A most popular new fruit, lately brought out in Massachusetts, often commanding $5 per barrel in the Boston market: ripe in November, and keeps till February.

Lady Apple, *Pomme d'Api.*—Fruit small; of pale yellow colour, deeply tinged with red on one side; flesh crisp and pleasant: ripe in November, and keeps till April.

Monstrous Pippin, *Gloria Mundi, Ox Apple.*—Fruit of enormous size, sometimes weighing 28 ounces; of a pale yellowish-green colour; sprightly flavour: ripe in October, and keeps till January.

Newton Pippin.—Of this most valuable apple there are two varieties, the yellow and the green; no difference in quality; keeps till May, and retains its flavour: the most valuable variety for shipping to Europe.

Rhode Island Greening.—Fruit large; skin greenish yellow; flesh slightly acid and of fine flavour: keeps from November till April.

Ribston Pippin, also called Formosa Pippin, and Glory of York. In England esteemed very highly; medium size, and globular form; colour yellow, mottled with red next the sun: keeps till February.

Roxbury Russeting.—A fine old native of Massachusetts; fruit large and of a slightly flattened form; colour brownish-yellow russet, with an occasional blush next the sun; skin rough: keeps well till June and July. Raised in great quantities near Boston for exportation, &c.

Swaar Apple.—A celebrated winter fruit in some parts of New-York; of fine flavour; skin greenish-yellow, tinged with a blush: keeps till March.

Wine Apple, *Hay's Winter, Large Winter Red, Fine Winter.*—A beautiful fruit, highly esteemed in the Philadelphia market: keeps till February.

Hollow-core Pippin.—A new variety raised in Jefferson county, Ohio. It resembles the yellow Newton pippin in its fine flavour: keeps till April and May.

Ohio Pearmain.—A new and beautiful variety in Ohio; good size; striped red and yellow; quality excellent: keeps till May.

Cider Apples.

Harrison and Camfield.—Both long raised in the neighbourhood of Newark, New-Jersey, and Hugh's Virginia Crab, much cultivated in Pennsylvania and Ohio, are decidedly the most valuable varieties for cider to be found in the country.

In the west and other portions of our widely-extended country many new varieties of choice apples are constantly coming into use. The above are varieties found at most of the nurseries in the Eastern States.

Besides these, there are a large quantity cultivated throughout the country of every shade of merit. The Newton pippin, Baldwin, Rhode Island greening, and Roxbury russeting are the most valuable for exportation, both on account of their flavour and hardihood. They command from $9 to $15 the barrel in Europe.

Directions for planting and mana-

ging apple orchards, chiefly from Kenrick:

"The seeds of the apple should be sown in autumn in a rich soil. When the young plants appear in spring, they should be carefully thinned to the distance of 2 inches asunder, and kept free from weeds till of sufficient size to be removed.

"At 1 or 2 years of age they are taken up, their tap-roots shortened, that they may throw out lateral roots; they are transferred to the nursery, set in rows about 4 feet asunder, and at 1 foot distance from each other in the row, in a rich and loamy soil. In the summer following they are inoculated, or they are ingrafted or inoculated the year following.

"*Size and age for transplanting to the Orchard.*—An apple-tree, when finally transplanted to the orchard, ought to be at least 6 or 7 feet high, with branches in proportion, and full 2 years from the bud or graft, and thrifty. Apple-trees under this size belong properly only to the nursery.

"*Distance.*—The distance asunder to which apple-trees should be finally set, when transplanted to the orchard, depends upon the nature of the soil, and the cultivation to be subsequently given. If the soil is by nature extremely fertile, 40 feet distance may be allowed, and even 45 and 50 feet in some very extraordinary situations; for before the trees become old, they will completely shade the ground. If, however, the soil is not very extraordinary by nature, or so rendered by art, this distance would be too great: for the trees would become old, and their growth would be finished before the ground could be covered by their shadow: 30 feet only may therefore be allowed in land usually denominated of good quality, and but 20 to 25 feet in land of ordinary quality. But where economy of time, of land, and of all things else is consulted, but one half this distance will answer for a series of years.

"The quincunx mode is recommended for close arrangement, and short-lived trees may be set in the intervals.

"The period of growth, or the duration of the apple-tree, is comparatively limited; this is sufficiently evident from the perishable nature of its timber.

"*Soil and Situation.*—A rich soil, rather moist than dry, is that adapted to the apple-tree.

"On such a soil, whether on the plains, or in the valley, or on the sides and summits of our great hills, and even in situations the most exposed, the apple-tree will flourish.

"*Management of the Land.*—If the ground intended for the orchard cannot conveniently be kept wholly in a state of cultivation during the first years, a portion, at least, ought to be.

"A strip of land to each row of 8 or 10 feet in width, well manured, may be kept cultivated, and the vegetables which may here be raised will amply repay the expense and labour bestowed during the first 4 or 5 years. After this, if the trees have grown well, as they probably must have done, cultivation at a distance in the intervals becomes even more important than within the limited distance of a very few feet from the trunk of the tree; for, on examination, it will be found that the small fibres or spongelets, by which alone the tree derives all the nourishment it receives from the earth, are now remote from the trunk of the tree; they are now to be found seeking food beyond the limits of its shade, and it becomes necessary that the whole ground should be kept in a high state of cultivation for the 4 or 5 following years. After this period it may occasionally be laid to grass, which, however, should be broken up at frequent intervals, the land being always kept in good heart.

"*Pruning.*—If the branches of a young tree, issuing at and above the requisite height, be made, by pruning, to diverge from the trunk in every direction above the horizontal, and the interior of these be carefully kept from any interference with each other for a few years, little pruning will ever afterward be necessary.

"Heavy pruning is seldom necessary or advisable; but when, as in the case of grafting, or of heading down for a new growth, it becomes unavoidable, it should always be performed in that interval between the time the frost is coming out of the ground in spring and the opening of the leaf.

"For that moderate pruning, which alone is generally needful, June and July, and during the longest days of summer, is the very best time; for wounds of all kinds heal admirably at this period, the wood remaining sound and bright; and even a tree debarked at this season recovers a new bark immediately.

"Trees ought not to be pruned in February and March, at the time the frost is coming out of the ground. This is the season when most trees, and particularly the vine and sugar-maple, bleed most copiously and injuriously. It causes inveterate canker, the wounds turn black, and the bark, for perhaps several feet below, becomes equally black, and perfectly dead in consequence of the bleeding."

Mr. Pell, who has an orchard of 20,000 Newton pippins, has succeeded, by the following method, in inducing the trees to bear crops every year:

"Three years ago in April, I scraped all the rough bark off from several thousand trees in my orchard, and washed the trunks and limbs within reach with soft soap, trimmed out all the branches that crossed each other early in June, and painted the wounded part with white-lead to keep out moisture, then split open the bark by running a sharp-pointed knife from the ground to the first set of limbs in the latter part of the same month, which prevents the tree from becoming bark-bound, and gives the inner wood an opportunity of expanding. In July I placed one peck of oyster-shell lime around each tree, and left it piled about the trunk until November, during which three months the drought was excessive. In November the lime was dug in thoroughly. The following year (1842) I collected from those trees 1700 barrels of fruit, some of which was sold in New-York for $4 per barrel, and others in London for $9. After gathering the fruit in October, I manured the same trees with stable manure, and covered it immediately with earth. Strange as it may appear, this year they are literally bending to the ground with the finest fruit I ever saw. The other trees in my orchard, not treated as above, are barren, next year being their bearing year."

Fruit for exportation and spring use must be allowed to ripen well, be plucked with the hand, and carefully exposed on the barn floor to dry for 15 to 20 days; they should then be placed in clean barrels, and stored in a dry cellar not subject to frost. In shipping, they should never be jolted. They should be placed between decks, in an airy situation. Fruit grown in dry seasons always keeps best.

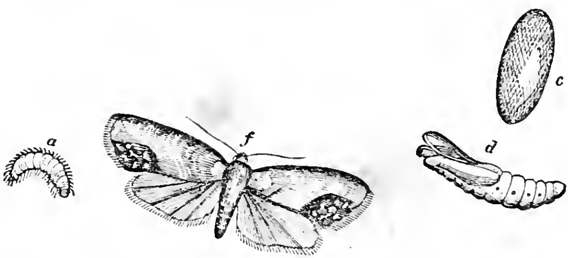
The products of the apple-orchard are so numerous that there is no locality in which it may not be made profitable. Not only does the fruit command a good price, but cider and vinegar are easily obtained, while hogs flourish on the fallen fruit, destroying, at the same time, the fruit caterpillar. The pomace, or refuse of the cider-mill, is very acceptable to cows and swine, or contributes to enrich the manure heap. See *Cider*.

Indeed, the value of apples as food for hogs is little appreciated; but there is abundant evidence furnished by practical men that they are almost as valuable as potatoes. The flesh is very firm and fine in swine thus fattened.

Insects.—Numerous insects affect the apple and pear tree, either boring the trunk, destroying the young leaves, or inhabiting the fruit. The fruit caterpillar (*Tortrix pomonana*) causes the fall of many apples before the ripening season. The moth (*fig. f*), whose eggs produce the destructive worm, is to be seen in the evenings of June and July flying about the trees, or on the windows of the house.

Its outer wings are marked with gray and brown lines arranged in delicate waves, with one large brown spot on each, surrounded with a yellow margin; the head and thorax are brownish-gray, striped; the under wings and abdomen are of a satin orange colour. They deposite an egg on several young fruit, and prefer early varieties. A worm is produced in 4 days, which enters the apple, eating towards the core, and finally through the fruit. In three weeks or more the caterpillar (*a*) escapes, but before this the apple usually falls to the ground, and it seeks a shelter among the rough bark of the tree or other suitable place to spin a cocoon (*c*). The chrysalis, or grub (*d*), is of a mahogany colour; it remains concealed until the next spring before leaving its nest as a moth. It is stated by European writers that there is another moth, which produces two generations annually, in the spring and fall.

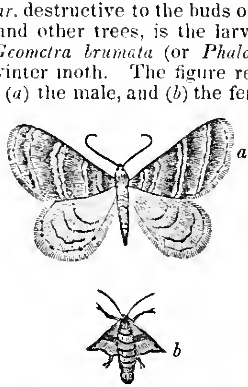
Smoking the trees during the appearance of the moth with tobacco,



pitch, and other pungent vapours, is used with some success. The collection of fallen fruit once or twice a day secures the worm, which may be destroyed; but they instinctively leave the apple soon after its fall. Rags, or straw bands tied around the stem, serve as a decoy to the caterpillar to form his cocoon under their shelter. The figures from Kollar represent this troublesome insect, which infests pears and other fruits likewise: it is the codling moth of European writers.

The *caterpillars* which exist in such large quantities in webs at the junction of the branches, and devour the spring foliage of apples and most trees, are the larvæ of the *Clissiocampa neustria*, *Americana*, and other species; they are readily destroyed by either collecting the nests and burning them, or by applying a sponge dipped in strong hartshorn, a solution of sulphuret of lime, or any other powerful poison. They are called lackey or tent caterpillars by European writers.

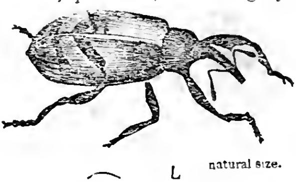
The Cankerworm, *green looper caterpillar*, destructive to the buds of apples and other trees, is the larva of the *Geometra brumata* (or *Phalæna*), the winter moth. The figure represents (*a*) the male, and (*b*) the female



moth. The male is winged, but the female crawls only; she may be seen ascending the trunk of trees in the fall to deposite her eggs in the autumnal buds: and is of an ash-gray colour. The caterpillars are at first gray, but afterward light green; they devour flowers, leaves, and fruit; and when they take up their abode on any part, construct a small web or cell for protection. About May they begin to leave the tree, descending by a thread to the soil; here they bury themselves to become puppæ, and reappear as moths from August to November. The destruction of the female moths is attempted by fastening strips of paper smeared with tar round the trunk, which arrests their ascent. Kollar recommends the construction of a box around the lower part of the trunk, covered on all sides with a projecting top, to be kept smeared with tar. The caterpillars are also fumigated with tobacco, &c., smoke. Other geometers also infest fruit trees.

APPLE-BORER. The *Saperda bivittata*, Say. See *Borers*.

THE APPLE-WEEVIL, *Curculio (Anthonomus) pomorum*, is of a grayish



natural size.

colour, deposites her eggs in the flower buds in spring; the grub is small, white, with a black head, it becoming yellow. The flowers and fruit are destroyed by them. The curculio may be shaken from the tree in spring, and destroyed by chickens. The trees are also subject to aphides, American blight, other caterpillars, &c.

APRICOT. (*Armeniaca vulgaris.*) The following remarks are by Mr. Pell:

"This fruit does exceedingly well when budded towards the end of July, on plum stocks two years old. The peach answers very well likewise When three years old, I set them out in a very rich black mould. I find they do much better under glass than in the open air. In either case they should be disbudded in the month of May, and all the superfluous shoots taken off In November they should be shortened to sixteen inches; by so doing the trees will be kept vigorous and healthy. Their principal enemies are the curculios, wasps, and flies, which may be kept off by means of nets."

The Moorpark and Turkey are both esteemed varieties, as also the following: breda, gold blotch, musk Schuylers, orange, peach, and violet. Lindley recommends grafting on the *mussel* plum stock. The position o. the tree ought to be sheltered and late. It answers admirably in the South, where it is grown as a standard, but in New-York it requires a warm wall.

APRIL. This is the great month for ploughing and seeding crops in the North; the land should be prepared for potatoes, beets, and root crops, as well as corn. Tobacco seed is sown early, and farther south the young plants of cotton and sugar-cane are hoed and weeded. The garden and orchard are to be closely attended to.

APTERANS, APTERA. Wingless insects.

APYREXIA. The cool or quiet stage of intermittent fevers.

AQUA FORTIS. Nitric acid, usually dilute.

AQUA REGIA. A mixture of nitric and muriatic acids.

AQUATIC PLANTS. Such as grow submerged.

AQUEOUS HUMOUR. The fluid in the anterior chamber of the eye

ARABLE LAND, so called from the Latin word *arare*, "to plough." is that part of the land which is chiefly cultivated by means of the plough.

Land in general is divided into arable, grass land, wood land, common pasture, and waste. The first of these is by far the most important in agriculture. In this article we shall briefly explain the principles on which are founded the most improved methods of cultivating arable land, by which the natural produce of the soil is greatly increased, and many productions are obtained in perfection which are foreign to the soil and climate.

1. We shall consider the nature and properties of various soils.

2. The best modes of preparing and

improving the natural soil, so as to increase its produce.

3. The most advantageous succession of crops, so as to obtain the greatest returns with the least diminution of fertility.

1. Soils.—When the surface of the earth is penetrated, we generally find that the appearance, texture, and colour vary at different depths. There is a layer of earth nearest the surface, of greater or less thickness, which covers the more solid and uniform materials which lie below it. This may be particularly observed wherever there are natural or artificial excavations or pits. A distinct line, nearly parallel to the surface, generally marks the depth of the upper soil, and separates it from the subsoil. The soil is more or less composed of minute parts of various kinds of earth, mixed with animal and vegetable substances in different states of decomposition; and to these, in a great measure, it owes its colour, which is generally darker than that of the subsoil. Except where iron, peat, coal, or slate abound in the soil, a dark colour is an indication of corresponding fertility. The rich soil of gardens long cultivated and highly manured is nearly black. As the soil is the bed in which all vegetable productions are to be reared, and in which they are to find their proper nourishment, its texture and composition become objects of great importance to the cultivator; and, without a competent knowledge of these, no practical rules can be laid down or depended upon.

All soils are composed of earthy and metallic oxides, saline substances, vegetable and animal matter, and water. The earths are chiefly clay or alumina, flint or silica, and lime.

Magnesia, barytes, and other earths are occasionally met with, but in so few instances that they may be omitted in the list.

Of the metals, the most abundant is iron in the state of peroxide. The other metals are rarely found near the surface.

Saline substances form a small part of a soil, but an important one.

Potassa exists in almost every vegetable, soda in a few, and ammonia is produced by the decomposition of animal matter; but, from its volatile nature, it is not long retained in the soil, except when it forms a fixed compound with other substances.

The vegetable acids, as a general rule, are perhaps limited to small portions of acetic acid in combination with some base, as lime or potash.

The mineral acids are found united with earths and alkalies, in the state of neutral compounds.

These saline substances have a powerful effect on vegetation; and a knowledge of their proportions in the soil, and of their various qualities, is indispensable in order to modify or correct their action by other substances for which they have an affinity.

Water, in a state of combination, or of mere mechanical diffusion, is essential to the growth of all plants: without it and atmospheric air there is no life, either animal or vegetable.

The Earths.—Clay is called alumina because it is obtained in its purest state from alum, in which it is combined with the sulphuric acid: it is the basis of all strong and heavy soils. When clay is minutely divided, it is easily suspended in water; when dried slowly, and stirred while drying, it becomes a fine powder, soft to the feel; and when kneaded with water, a tough, ductile mass, easily moulded into hollow vessels which retain liquids. This property of being impervious to water gives the specific character to clay as an ingredient of the soil. In a pure and unmixed state it is absolutely barren. When clay is heated to a great degree it parts with the water combined with it; it is then said to be baked, as we see in bricks. It is no longer diffusible in water.

Silica, or the earth of flints, suffers no change in water. It consists of crystals, or fragments of very hard stone, forming gravel or sand according to their size; and the finest siliceous sand, when examined with a magnifying glass, has the appearance of irregular fragments of stone without any cohesion between them.

Silicious sand holds water in its interstices by simple cohesive attraction in proportion to its fineness. It lets water pass through it rapidly, either by filtration or evaporation. Its use in the soil is to keep it open, to let the air and water, as well as those other substances on which the growth of plants depends, circulate through it. Unmixed, it dries so rapidly that no vegetation can continue in it, unless a constant supply of moisture be given by irrigation. A small addition of clay much improves light sands.

Lime in its pure state is familiar to every one as the basis of the mortar used in building. It is produced by burning marble, chalk, limestone, or shells with a great heat. In the stones which are formed principally of lime it is combined with some acid, most generally carbonic acid, which separates from it by the operation of burning, in the form of an air or gas, hence called *fixed air*, from its being thus *fixed* in a stone. These stones, of various degrees of hardness, are now all classed under the name of carbonates of lime.

Lime unites readily with water, which it also absorbs from the atmosphere. It then becomes *slacked*. By uniting with carbonic acid, it returns to its former state of carbonate, with this difference, that, unless much water be present, it remains a fine impalpable powder. Pure lime is soluble in water, though sparingly; a pint of water cannot dissolve more than about twenty grains: the carbonate is not soluble in water. Carbonate of lime has a powerful effect on the fertility of a soil, and no soil is very productive without it. It is consequently used extensively as an improver of the soil, otherwise called a manure; but its use in this respect, and the mode in which it acts, will be given in the articles MANURE and LIME.

Carbonate of lime, as an earth, is neither so tenacious as clay nor so loose as sand. In proportion to the fineness of its particles, it approaches the one or the other; when the parts are large and hard, it takes the name of limestone or calcareous gravel.

Its distinguishing feature is its solubility in acids, which it neutralizes, depriving them of their noxious qualities in the soil. A proper mixture of these three earths, in a due state of mechanical division, forms a soil well fitted to the growth of every species of plants, especially those which are cultivated for food; and nothing more is required than a proper climate as to heat, a proper degree of moisture, and sufficient nourishment, to make all the plants generally cultivated thrive most luxuriantly in such a mixture, which is usually called a loam.

But there are some soils which, besides a proper mechanical texture and mixture of earths, contain a large proportion of a natural manure, which renders them extremely fertile. This is a substance produced by the slow decay of animal and vegetable matter. It can be separated from the other parts of the soil, and has been accurately analyzed and described by many of the most experienced chemists, particularly by Fourcroy, Davy, Chaptal, and Theodore de Saussure. (See *Recherches Chimiques sur la Végétation*, Paris, 1804, 8vo.) This substance has been called *vegetable mould*; but, as this is not a very distinct term, we shall, after Thaer and other eminent writers on agriculture, adopt the name of *humus* when speaking of it. Humus is a dark, unctuous, friable substance, nearly uniform in its appearance. It is a compound of oxygen, hydrogen, carbon, and nitrogen, which are the elements of all animal and vegetable substances. It is the result of the slow decomposition of organic matter in the earth, and is found in the greatest abundance in rich garden mould, or old, neglected dunghills. It varies somewhat in its qualities and composition, according to the substances from which it has been formed and the circumstances attending their decay.

Besides the four essential elements in its composition, it also contains other substances in smaller quantities, viz., phosphoric and sulphuric acids combined with some base, and also earths and salts. It affords food to plants. It is diminished by the process of vegetation, and wasted by being carried into the ocean by the waters, or it is carried into the atmosphere by the agency of the oxygen of the air, which converts it into gaseous matter, chiefly carbonic acid.

Humus, in the state in which it is usually found in the earth, is not soluble in water, and we might have some difficulty in comprehending how it enters into the minute vessels of the roots of plants; but here the admirable provision of nature may be observed. Humus is insoluble and antiseptic; it resists farther decomposition in itself, and in other substances in contact with it. It remains for a long time in the earth unimpaired; but no sooner is it brought into contact with the atmosphere by the process of cultivation, than an action begins. Part of its carbon, uniting with the oxygen of the atmosphere, produces carbonic acid, which the green parts of plants readily absorb; while its hydrogen, with the same, forms water, without which plants cannot live; and in very warm climates, where this process goes on more rapidly, the moisture thus produced keeps up vegetable life when rains and dews fail. The residue becomes a *soluble extract*, and in that state is taken up readily by the fibres of the roots. Hence we see the great importance of frequently stirring the surface of the earth between vegetables.

We can now readily understand the great importance of humus, and of those rich manures which are readily converted into it, when not immediately absorbed by plants. But it has still another property, highly important to fertility: it renders stiff clays porous, and consolidates loose sands. It does so more than lime or any other earth. Hence a soil with a considerable portion of humus is much more fertile than the quantity of alumina or of sand in its composition would lead one to expect, as we shall see when we come to the analysis of soils of known fertility; and we see the great advantage of animal and vegetable manures, not only as nourishment to vegetables, but as mechanical improvers of the texture of soils.

The greatest enemy of humus is stagnant water: it renders it inert and astringent, as we see in peat; and soils abounding with vegetable matters, from which water is not properly drained, become *sour*, as is very justly said, and produce only rushes and other useless and unpalatable plants. The remedy is simple and obvious: drain well, and neutralize the acid with lime or marl; by these means abundant fertility will be restored.

In very light soils humus is seldom found in any quantity, being too much exposed to the air, and rapidly decomposed; the extract is washed through them by the waters, and, as they waste manure rapidly, they are called *hungry*. Such soils are very unprofitable until they are improved and consolidated by clay or marl, which makes them retain their moisture.

With calcareous earths humus acts well, provided they are pulverized and of sufficient depth.

In order to ascertain the probable fertility of a soil, it is very useful to analyze it, and find out the proportion of its component parts. To do this with great accuracy requires the knowledge of an experienced chemist. See *Analysis*.

Mr. Thaer has given a classification of soils of known qualities, which we think worthy of notice. It is as follows:

No.		Clay, per cent.	Sand, per cent.	Carb. of Lime, per cent.	Humus, per cent.	Value.
1	First class of strong wheat soils	74	10	4½	11½	100
2		81	6	4	8½	98
3		79	10	4	6½	96
4		40	22	36	4	90
5	Rich light sand in natural grass	14	49	10	27	?
6	Rich barley land	20	67	3	10	78
7	Good wheat land	58	36	2	4	77
8	Wheat land	56	30	12	2	75
9	Do.	60	38	very insignificant quantities.	2	70
10	Do.	48	50		2	65
11	Do.	68	30		2	60
12	Good barley land	38	60		2	60
13	Do. second quality	33	65		2	50
14	Do.	28	70		2	40
15	Oat land	23½	75		1½	30
16	Do.	18½	80		1½	20

Below this are very poor rye lands.

In all these soils the depth is supposed the same, and the quality uniform to the depth of at least 6 inches; the subsoil sound, and neither too wet nor too dry.

Nos. 1, 2, and 3 are alluvial soils, and, from the division and the intimate union of the humus, are not so heavy and stiff as the quantity of clay would indicate.

No. 4 is a rich clay loam, neither too heavy nor too loose: a soil easily kept in heart by judicious cultivation

No. 5 is very light and rich, and best adapted for gardens and orchards, but not for corn; hence its comparative value can scarcely be given.

Nos. 6, 7, and 8 are good soils; the quantity of carbonate of lime in No. 8 compensates for the smaller portion of humus. This land requires manure, as well as the others below. In those from No. 9 downward lime or marl would be the greatest improvement. Nos. 15 and 16 are poor light soils, requiring clay and much manure; but even these lands will repay the cost of judicious cultivation, and rise in value.

The last column, of comparative value, is the result of several years' careful valuation of the returns, after labour and seed had been deducted.

Few old soils contain more than 4 or 5 per cent. of humus, even when in very good heart; and 2 per cent., with a good loamy texture, will render a soil fit for corn with judicious cultivation. The texture is of most importance, as may be seen by comparing Nos. 7 and 8 with No. 6. If this is of good quality, dung will soon give the proper supply of humus.

The depth of the soil and the nature of the subsoil greatly affect its value. However rich it may be, if there is only a thin layer of good soil over a sharp gravel or a wet clay, it can never be very productive: in the first case, it will be parched in dry weather; and in the latter, converted into mud by every continued rain. If the subsoil be loam, six inches of good soil will be sufficient. With a foot of good soil, the subsoil is of little consequence, provided it be dry, and the water can find a ready outlet.

The exposure, with respect to the sun, and the declivity of the ground, are very important circumstances, and equivalent to an actual difference in the climate. A gentle declivity towards the south, and a shelter against cold winds, may make as great a difference as several degrees of latitude.

2. Cultivation of the Soil.—The better the soil, the less cultivation it requires to produce tolerable crops; hence, where the land is very rich, we find in general a slovenly culture; where the ground is less productive, more labour and skill are applied to compensate for the want of natural fertility. The simplest cultivation is that of the spade, the hoe, and the rake, and on a small scale it is the best; but spade husbandry cannot be carried to a great extent without employing more hands than can be spared from other occupations. The plough, drawn by oxen or horses, is the chief instrument of tillage, and has been so in all ages and nations of which we have any records. Its general form is familiar to every one, and requires no minute description. The various kinds of ploughs in use at different times, and the improvements which have been made and are attempted daily, will be noticed in a separate article (see *Plough*). Suffice it to say, at present, that a plough should, as much as possible, imitate the work done with a spade. It should cut a slice from the land by its coulter vertically, and by the share horizontally lift it up, and turn it quite over by means of the mouldboard; and the art of the ploughman consists in doing this perfectly, and with such a depth and width as suit the soil and the intended purpose. In tenacious soils the slice will be continued without breaking, especially if bound by the fibres and roots of plants; the whole surface will be turned over, and the roots exposed to the air. It is of great

consequence that each slice be of the same width and thickness, and the sides of it perfectly straight and parallel. The plane of the coulter must be perfectly vertical, and that of the share horizontal, in order that the bottom of the furrow may be level, without hollows or *balks*, which are irregularities produced by the rising or sinking of the plough, or inclining it to either side. There are various modes of ploughing land, either quite flat, or in beds or stitches—that is, in portions of greater or less width, with a double furrow between them, somewhat like beds in a garden. Sometimes two ridges are set up against each other, which is called ridging or *bouting*; the land then is entirely laid in high ridges and deep furrows, by which it is more exposed to the influence of the air, and kept drier: this is generally done before winter, especially in stiff, wet soils. Sometimes two or more ridges are made on each side, forming narrow stitches. When the ground is to be ploughed without being laid in stitches, and all the ridges inclined one way, the mould-board of the plough is shifted at each turn from one side to the other. The double mould-board plough of Barnaby and Mooers does this effectively. When grass land or stubble is ploughed, care must be taken to bury the grass and weeds completely, and the slice cut off by the plough must be turned over entirely, which is best done by making the width of the furrow greater than the depth. When the grass and weeds are rotten, and the ground is ploughed to pulverize it, a narrow, deep furrow is best; the earth ploughed up is laid against the side of the preceding ridge, which forms a small furrow between the tops of the ridges, well adapted for the seed to lodge in and to be readily covered with the harrow.

Nothing has divided both practical and theoretical agriculturists more than the question whether the land should be ploughed deep or shallow; but a very slight attention to the purposes for which land is ploughed, and to the nature of the soil, will readily reconcile these apparently contradictory opinions. A deep, rich, and stiff soil can never be moved too much nor too deep: deep ploughing brings up rich earth, admits the air and water readily, and gives room for the roots to shoot, while the rich compact soil affords moisture and nourishment. Wherever trees are to be planted the ground should be stirred as deep as possible, even in a poor soil: for grass and corn, this is not always prudent; their roots seldom go above three or four inches deep, and if they find sufficient moisture and humus, they require little more depth.

Whenever the soil below a certain depth is of an inferior quality, there can be no use in bringing it up; and where the soil is light and porous, the bottom had much better not be broken.

The great object in ploughing land is to divide it, expose every part of it to the influence of the elements, and destroy every plant or weed but those which are sown in it. To do this perfectly requires several ploughings.

Where the soil is good, with a porous subsoil, the greatest care should be taken not to go too deep; but where the subsoil is compact and impervious to water, but not wet for want of outlet or draining, it is useful to stir the soil to a great depth, but without bringing it to the surface, which may be done by a plough without a mould-board following a common plough in the same furrow. This is an excellent mode of draining, and, at the same time, keeping a reservoir of moisture, which in dry weather ascends in vapours through the soil and refreshes the roots.

The mode in which the soil is prepared most perfectly for the reception of the seed is best shown by following the usual operations on fallows: After the harvest, the plough is set to work and the stubble ploughed in. The winter's frost and snow mellow it, while the stubble and weeds rot below. In spring, as soon as the weather permits, it is ploughed again, the first ridges being turned over as they were before: this completes the decomposition of the roots and weeds. It is then stirred with harrows or other instruments, which tear up the roots which remained, and some of these, not being easily destroyed, are carefully gathered and burned, or put in a heap to ferment and rot, a portion of quicklime being added. Another ploughing and stirring follows, at some interval, till the whole ground is mellow, pulverized, and free from weeds; manure is put on, if required, and immediately spread and ploughed in: the land is then prepared for the seed.

Various instruments have been invented to stir the earth and mix it without so often using the plough, and also to loosen and separate roots and weeds; of these the principal are the cultivator or scarifier, which enters but a few inches into the ground, and moves a great surface by means of iron teeth of various constructions.

This instrument divides the soil, but does not turn it over; it is well calculated to destroy roots and weeds, and let in the air; but, evidently, is only adapted to tolerably loose and mellow soils, where there are no large stones.

When the soil turned up by the plough is in large, hard lumps, a roller, sometimes with spikes in it, is drawn over the land to break the clods; but this is seldom necessary except where very stiff soils have been ploughed when too wet, and the ridges have dried, and been ploughed again in dry weather. Deep wet clay soils should be carefully watched, to know when is the proper time to plough them. Nothing pulverizes them like frost; and if they are kept from wet by careful draining and numerous water-furrows in autumn, they will be loose and friable in spring; they had better not be touched than worked when too wet. On light soils the plain roller is used to advantage to produce firmness, without which the plough cannot so well turn the ground over completely, but merely pushes it to the right and left.

The influence of the atmosphere on the soil, and the increased fertility produced by pulverizing and stirring heavy lands, has led to the notion adopted by Jethro Tull, that labour might entirely supersede the necessity of manure; hence the origin of the horse-hoeing husbandry, which at one time was so highly thought of as to be called, by way of distinction, the *new* husbandry.

There are some soils which are so mixed with pebbles and stones that the foregoing observations will scarcely be applicable, and the instruments must be adapted to their texture. The only inconvenience found from them in good soils is that they occupy the room of better earth, and wear out the instruments used, which, in consequence, are made stronger and blunter. When there is a crop to be mown with the scythe, the stones must be removed from the surface.

When the land has been duly prepared, the seed is sown. This is done sometimes before the last ploughing, but then the manure should have been ploughed in before; for, except in planting the potato, which is not a seed, but a bulb, the manure should always be deeper, and not in contact with the seed. When the seed is ploughed in, the furrow should not be above two or three inches deep and eight or nine wide; and it is only in particular soils that this mode is to be recommended. The most common method is to sow the seed on the land after the last ploughing, and draw the harrows over to cover it. When the land has been well ploughed, the seed will mostly fall in the small furrows made by two adjoining ridges, and rise in regular rows; but by far the most perfect way is to sow it at a regular depth, by means of a machine, and in rows at regular distances. See *Drill*.

The proper season for sowing each kind of grain, the choice of seed, and other particulars, will be given under the name of the different seeds usually sown. As a general rule, it may be observed, that the smaller the seed, the less it must be covered, and clover or grass seed is not usually harrowed in, but only pressed in with the roller.

3. Succession of Crops, or Rotations.—It has been found by experience that, besides the general exhaustion of humus, each kind of crop has a specific effect on the soil, so that no care or manure can make the same ground produce equal crops of the same kind of grain for any length of time without the intervention of other crops. Whether this be owing to any peculiar nourishment necessary to each particular kind of plants, or because plants not indigenous degenerate in a foreign soil, the fact is certain with respect to most crops usually raised, and particularly red clover. This points out the advantage of varying the crops, according as they are found to succeed best after each other. In general, all kinds of grain succeed best after a crop which has been cut before the seed has ripened or the stem is dried up. Those plants which have a naked stem with few leaves thrive best after leguminous plants, which have more succulent stems and more leaves, and which bear their seeds in pods, as pease, beans, tares, or vetches; or after esculent roots, which strike deep into the ground, as carrots, parsnips, beet-roots, and turnips. From this circumstance, confirmed by universal experience, the different systems of rotation have had their origin, taking the nature of the soil into consideration.

The Norfolk rotation is, 1. Turnips, well manured; 2. Barley; 3. Clover; 4. Wheat: by which a sufficiency of food for sheep and cattle is obtained without natural pastures, and the land, manured every fourth year at least, is kept in a regular state of progressive improvement.

A very common rotation in Scotland is, fallow, wheat, clover, or grass, fed one, two, or three years; then oats, pease, or beans, and wheat again, if the land is clean and in good heart; for there is no rule better established than that of never allowing the soil to be exhausted beyond a certain point, where manure and tillage can readily recruit it. The greedy cultivator is sure to pay dearly in the end for every crop forced from the land unreasonably.

The Flemish husbandry proceeds much on this principle. The greatest attention is paid to manuring and weeding. Much more manual labour is bestowed, and the crops seem more certain, varied, and abundant. That it is not unprofitable, we may conclude from the wealth of the peasants, the comfort of the labourers, and the sleek appearance of the cattle. From the very interesting account of Flemish agriculture in the work of Mr. Van Aelbroek, of Ghent, we learn with what great care the soil is cultivated in Flanders. After ploughing lands, every intervening furrow is deepened and cleared with the spade, the earth being thrown over the bed sown. Liquid manure, chiefly the urine of animals and drainings of dunghills, is carefully collected, and is carried on and distributed over the poor light soils by means of water-carts, before sowing, and again when the crop is come up. By this means such lands are made to yield crops of rape seed, clover, lucern, flax, and corn, equal in luxuriance to those on the richest soils. Fallows are rendered unnecessary by the careful destruction of weeds; in short, it is a garden culture on an extended scale. All the land is in tillage, except where rivers occasionally overflow, and render the meadows rich and profitable. The cattle are mostly kept in stables, and fed with green food cut and brought to them, by which means one acre of clover, lucern, or other artificial grass will maintain five times as many beasts, or more, as an acre of the best pasture. But the great object is to increase manure, especially in a liquid state, which is carefully preserved in reservoirs, without loss or waste, till wanted for the land. This system is also followed in Switzerland

In Holstein, on moderately good soil, they adopt the following course: 1. Oats, on newly broken-up grass land; 2. A fallow to destroy grasses and weeds, and accelerate the decomposition of their roots; 3. Wheat, with or without manure, according to the state of the land; 4. Beans, barley, or oats; 5. Wheat, manured, unless it has been done for the beans the year before: 6. Grass seeds pastured for three years or more, when the rotation begins again.

We have now given a brief outline of the manner in which arable land may be cultivated and improved. If we should be asked whether so much attention and labour upon land of a proper quality will be repaid by the value of the produce, we shall answer, without any hesitation, in the affirmative, provided the cultivator is possessed of knowledge, judgment, and experience, and devotes all his time to the superintendence of his farm.—(*W. L. Rham.*)

ARACÆ, AROIDÆ. The natural family of plants, including the arum, Indian turnip, and skunk cabbage.

ARACHNIDANS, ARACHNIDA. A class of apterous, spider-like condylopes, having the head confluent with the chest, and the body, consequently, consisting of but two segments, with eight legs, smooth eyes, and the sexual orifices situated on the thorax, or anterior part of the abdomen.

ARATION. Ploughing.

ARBOR. The principal spindle or axis of a machine.

ARBORESCENT. Inclining to, or becoming woody.

ARBORICULTURE. The cultivation of trees.

ARBORETUM. A place for the cultivation of trees.

ARBOR VITÆ. *Thuja occidentalis.* A well-known coniferous evergreen, of small size, but very durable. It abounds in the Northern States, and has been much recommended as a hedge. The plants are best raised from seed. There is a species from China much admired in the shrubberies of Europe.

ARBUSTUM. An orchard or vineyard.

ARBUTUS. A genus of handsome evergreen shrubs of the natural family Ericaceæ. The fruit is succulent, but austere, and in the *A. unedo* a beautiful object. The *Arbutus andrachne* is the most admired of this genus. The *A. uva ursi* yields a useful medicine. They are much cultivated as shrubbery plants in Europe, and belong to the first class for beauty.

ARCESTHIDA. A small succulent cone, as the juniper berry.

ARCHIL. A purple dye-stuff procured from the *Rocella tinctoria* and *fuciformis*, lichens growing on the rocks of the Canary Islands.

ARCHITRAVE. The chief beam or structure resting immediately upon the columns of an edifice, the lowest member of the entablature; also called the epistylium.

ARCUATE. Bent like a bow.

ARECA. An East Indian palm, the nut of which is chewed with the betel.

ARENACEOUS. Sandy, relating to sand.

AREOLÆ. In entomology, the small spaces between the nervures of the wings.

AREOMETER. An instrument for taking specific gravities. See *Hydrometer.*

ARGIL, ARGILLACEOUS. Clay, clayey.

ARILLA, ARIL, ARIEL. A membranous prolongation of the placenta over a seed, as the mace of the nutmeg.

ARM OF A HORSE. The upper part of the fore legs.

ARMILLA. The coloured circle of the lower end of the fore leg, above the tarsus of birds.

ARMY WORM. See *Cotton, Diseases of.*

ARNOTTO. See *Annotta.*

AROMA, AROMATIC. A pleasant spicy odour, usually due to a volatile oil.

AROMATIC REED. *Acorus calamus.* Sweet flag, a common indigenous water plant, the rhizome of which is of a spicy odour. It is the *Calamus aromaticus* of the druggists.

ARPENT. The French acre of 51,691 sqare feet.

ARRACACHA. The South American name for an umbelliferous plant, the *Arracacia esculenta* of botanists, whose fleshy sweet roots are cultivated in Columbia and Jamaica, in the mountainous parts of those countries, in the same way as parsnips and carrots in Europe. The roots are of large size, and in quality are, when cooked, between a sweet chestnut and a parsnip. Attempts to introduce it into common European cultivation have uniformly failed.—(*Brande.*)

ARRACK. A whiskey of unpleasant odour, obtained by distilling the liquor of the fermented mush of rice. It is sometimes applied to other spirituous liquors.

ARROW-GRASS. The genus *Triglochin.* They are small marsh grasses, perennial, and flowering in July; some grow on salt marsh. They are eaten by cattle.

ARROW-HEAD. *Sagittaria sagittifolia.* A common indigenous, perennial, tuberose plant, with arrow-shaped leaves, growing in brooks. It is cultivated by the Chinese for its roots, which are mealy.

ARROW-ROOT. *Maranta arundinacea.* A herbaceous plant of the family Cannæ, with fleshy perennial roots, readily propagated by root-cuttings, which should be set a foot to eighteen inches apart, in drills. It is cultivated in Bermuda, the West Indies, and Florida. The roots are dug when a year old, washed, beaten into a pulp, then mixed with water, and agitated; the stringy parts are then separated by the hand. The starch, or *arrow-root*, remains suspended in the water; this is next strained through a linen cloth, and then allowed to settle, by which the starch subsides, and the water is removed; it is washed a second time, and dried. Arrowroot is a nearly pure starch, of agreeable flavour, but little nutrition. Good potatoes, rasped into a pulp and treated the same way, produce a starch, which is often used to adulterate the genuine article.

ARROW-WOOD. *Viburnum dentatum.* A small shrub with straight, stiff branches and blue berries: the wood is said to have been used by the Aborigines for arrows.

ARSENIC. Arsenious acid, white oxide of arsenic. A violent irritant poison, used injudiciously to destroy rats, and as an application to ulcers. The safest antidote is the recently-prepared hydrated oxide of iron: by precipitating a solution of per-nitrate of iron by solution of potash. Lime-water is much less certain.

ARTEMISIA. The genus of wormwoods.

ARTERIOTOMY. The opening of an artery to let blood.

ARTERY. The vessels which convey red blood are so called.

ARTESIAN WELLS, or fountains, are those springs or wells which constantly overflow their summits.

ARTHRODIC. An articulation of bones, in which the head of one is received into a shallow cavity of the other, so as to permit considerable motion. This is the case with the upper arm and shoulder.

ARTICHOKE. *Cynara scolymus.* A plant having the appearance of a gigantic thistle, cultivated for the flower-head, which is cut before flowering, boiled, and served with butter. They are propagated by seed and offsets. If by the former, sow the seed in rows, a foot apart, as soon as the frost is out of the ground. Thin the plants to a foot apart in the row, and, in the fall of the year, put out the plants in clumps of four in rows, three feet apart, and the rows six feet asunder. They will produce their fruit the next year. When winter approaches, earth the roots well up, and, before the frost sets in, cover all well over with litter from the yard or stable. Open at the breaking up of the frost; dig all the ground well between the rows; level the earth down from the plants. You will find many young ones, or offsets, growing out from the sides;

pull these off, and, if you want a new plantation, put them out as you did the original plants: they will bear, though later than the old ones, that same year. By great care, they may be made to bear three years.

ARTICHOKE, Jerusalem. *Helianthus tuberosus.* A small sunflower, with nutritious tubers. It yields from 150 to 200 bushels of roots, less in size than potatoes; the tops, cut before flowering, also produce abundant fodder. Hogs root up the tubers greedily, and thrive well upon them. When steamed or boiled, they are palatable. It is one of the plants found by Boussingault to draw its nitrogen almost entirely from the air; hence it is recommended as an ameliorating crop, when turned in before the tubers are formed.

It is usually propagated by sets from the roots in April, grows in any moist soil, especially such as is sandy and light: the cultivation is the same as for the potato. When raised for its tuber, it is liable to become troublesome, from the germinating power of even the smallest pieces left in the soil. It keeps in the ground all winter, or may be preserved under sand. In the Middle States it thrives well. It is extensively used in France as provender for cattle, hogs, &c., and is equal to potatoes in nourishment.

ARTICULATA, ARTICULATES. A term applied by Cuvier to a primary division of the animal kingdom, characterized by an external skeleton in the form of a series of rings articulated together and surrounding the body; by an internal gangliated nervous system, the ganglions being arranged symmetrically along the middle line of the body, and by having distinct respiratory organs. Insects and various worms are of this order

ARTICULATED. Jointed In botany it signifies a slight connexion, such as that of the leaf with the stem in exogens, which allows them to fall off when dead.

ARTICULATION. The connexion of the bones of the skeleton by joints.

ARUM. The genus of the Indian turnip.

ARUNDO. The reed plants. Several species, growing on sand, bind it together: arundinaceous, reed-like.

ARVICOLA. The genus of field-mice.

ASAFŒTIDA. A fetid gum resin obtained from the root of the *Ferula asafœtida*, whence it exudes, by incision, in the form of a milky juice, which, when dried by exposure to the sun, acquires a mottled appearance and pink colour. It is a native of the south of Persia, and is used in medicine as a stimulant and antispasmodic in hysteric and nervous disorders, and in spasmodic cough, asthma, and flatulent colic.

ASCARIS, (pl.) ASCARIDES. Intestinal worms. See *Worms.*

ASCI. Little membranous bags containing sporules. *Ascidium*, the leaf-pitcher.

ASCITES. Dropsy of the belly.

ASH-TREE. *Fraxinus excelsior.* European ash, a handsome tree, with valuable timber. The weeping ash is a variety. This tree is a native of America, but not very abundant. The white ash (*F. acuminata*) is a valuable and common tree of the United States. A sweet gum (*manna*) exudes from many species, especially from the *F. ornus* of Italy, and commands a high price at the druggists as a laxative medicine.

ASHES. The incombustible part of animal and vegetable substances. In agriculture several varieties are used, which will be briefly described.

Wood ashes are most abundant from leaves, bark, and young twigs. The composition differs with the tree and soil. The following analyses from Sprengel will serve as a general guide:

	Red Beech.	Oak.	Scotch Fir.	Pitch Pine. (Berthier.)
Silica . . .	5·52	29·95	6·59	7·50
Alumina . . .	2·33			
Oxide of Iron . .	3·77	8·14	17·03	11·10
Oxide of Manganese	3·85			2·75
Lime . . .	25·00	17·38	23·18	13·60
Magnesia . .	5·00	1·44	5·02	4·35
Potash . . .	22·11	16·20	2·20	14·10
Soda . . .	3·32	6·73	2·22	20·75
Sulphuric Acid .	7·64	3·36	2·23	3·45
Phosphoric Acid	5·62	1·92	2·75	0·90
Chlorine . .	1·84	2·41	2·30	——
Carbonic Acid . .	14·00	12·37	36·48	17.50
	100	100	100	96.0

Ashes are used with advantage to every crop, but especially as a dressing to that intended for gramineous plants and the cerealia; but turnips, potatoes, the white field carrot, and every crop, has been benefited by them. The application should differ with the object in view; six bushels are enough to advance a clover or lucern crop in the spring, but 15 to 20 bushels are sown as a dressing for an annual crop, as grain, barley, &c. Large doses should not be applied to the land with seed or upon young growth, as the carbonate of potash present sometimes injures them. They tell best on land rich in vegetable matter, upon which the potash and soda acts. On clayey soils ashes generally produce more rapid effects than on lighter kinds.

The action of all ashes is twofold, partly due to the soluble portions, and partly to the insoluble. The chloride of sodium, or common salt, the carbonate and sulphate of potash, are soluble, and produce immediate effects on the crop; but the phosphates and silicates, as well as carbonate of lime, require time to dissolve and benefit the crop. Hence it has been observed that some lands are permanently improved by ashes, and some crops immediately benefited, as the leguminous plants.—(*Sprengel.*) In those soils which already contain much alkali, as the detritus of primitive and transition countries, seashores, lands near salt springs, the soluble parts of ashes will be of little moment; and the leached remains may be altogether superior, for few soils contain so much phosphoric acid as not to be improved by an addition as manure.

Leached, or Washed Wood Ashes.—Where wood ashes are washed for the manufacture of the pot and pearl ash of commerce, this insoluble portion collects in large quantities. It is also present in the refuse of the soap-makers, where wood ash is employed for the manufacture of soft soap. The composition of this insoluble matter varies very much, not only with the kind of wood from which the ash is made, but also with the *temperature* it is allowed to attain in burning. The former fact is illustrated by the following analysis, made by Berthier, of the insoluble matter left by the ash of five different species of wood carefully burned by himself:

	Oak.	Lime.	Birch.	Pitch Pine.	Scotch Fir.	Beech.
Silica	3·8	2·0	5·5	13·0	4·6	5·8
Lime	54·8	51·8	52·2	27·2	42·3	42·6
Magnesia	0·6	2·2	3·0	8·7	10·5	7·0
Oxide of Iron	—	0·1	0·5	22·3	0·1	1·5
Oxide of Manganese	—	0·6	3·5	5·5	0·4	4·5
Phosphoric Acid	0·8	2·8	4·3	1·8	1·0	5·7
Carbonic Acid	39·6	39·8	31·0	21·5	36·0	32·9
Carbon	—	—	—	—	4·8	—
	99·6	100	100	100	99·7	100

The numbers in these several columns differ very much from each other; but the constitution of the insoluble part of the ash he obtained probably differed in every case from that which would have been left by the ash of the same wood burned on the large scale, and in the open air. This is to be inferred from the total absence of potash and soda in the lixiviated ash, while it is well known that common lixiviated wood ash contains a notable quantity of both. This arises from the high temperature at which wood is commonly burned, causing a greater or less portion of the potash and soda to combine with the silica, and to form insoluble silicates, which remain behind along with the lime and other earthy matter when the ash is washed with water. It is to these silicates, as well as to the large quantity of lime, magnesia, and phosphoric acid it contains, that common wood ash owes the more *permanent* effects upon the land, which it is known to have produced. When the rains have washed out, or the crops carried off the more soluble part from the soil, these insoluble compounds still remain to exercise a more slow and enduring influence upon the after-produce.

Still, from the absence of this soluble portion, the action of lixiviated wood ash is not so apparent and energetic, and it may therefore be safely added to the land in much larger quantity. Applied at the rate of two tons an acre, its effects have been observed to continue for fifteen or twenty years. It is most beneficial upon clay soils, and is said especially to promote the growth of oats.

Kelp is the name given to the ash left by sea-weeds when burned. As a natural mixture, which can be obtained at a cheap rate, and has been proved to be useful to vegetation in a high degree, it is very desirable that accurate experiments should be instituted with the view of determining the precise extent of its action, as well as the crops and soils to which it can be most advantageously and most economically applied.

Like wood ashes, kelp varies in composition with the species and age of the sea-weeds from which it is prepared, and like them also, it consists of a soluble and insoluble portion. Two samples, analyzed by Dr. Ure, consisted of

Soluble Portion.	Heisker.	Rona.	Normandy. Gay Lussac.
Carbonate of Soda, with Sulphuret of Sodium	8·5	5·5	—
Sulphate of Soda	8·0	19·0	—
Common Salt	36·5	37·5	56·0
Chloride of Potassium			25·0
	53·0	62·0	
Insoluble Portion.			
Carbonate of Lime	24·0	10·0	—
Silica	8·0	—	—
Alumina and Oxide of Iron	9·0	10·0	—
Gypsum	—	9·5	—
Sulphur and loss	6·0	8·5	—
	100	100	

Besides these constituents, however, the soluble portion contains iodide of potassium or sodium in variable quantity, and the insoluble more or less of potash and soda in the state of silicates and phosphates.

Kelp may be applied to the land in nearly the same circumstances as wood ash, but for this purpose it would probably be better to burn the sea-weed at a lower temperature than is usually employed. By this means, being prevented from melting, it would be obtained at once in the state of a fine powder, and would be richer in potash and soda.

It might lead to important results of a practical nature were a series of *precise* experiments made with this finely-divided kelp as a manure, especially in inland situations; for though the variable proportion of its constituents will always cause a degree of uncertainty in regard to the action of the ash of marine plants, yet if the quantity of chloride of potassium it contains be, on an average, nearly as great as is stated above in the analysis of Gay Lussac, kelp will really be the cheapest form in which we can at present apply potash to the land.

Straw Ashes.—The ashes obtained by burning the straw of oats, barley, wheat, and rye contain a natural mixture of saline substances, which is exceedingly valuable as a manure to almost every crop. The proportion of the several constituents of this mixture, however, is different, according as the one or the other kind of straw is burned. Thus, 100 parts of each variety of ash, in the samples analyzed by Sprengel, consisted of

	Oats.	Barley.	Wheat.	Rye.	Rape.
Potash	15·2	3·4	0·6	1·2	18·8
Soda	trace	0·9	0·8	0·4	11·2
Lime	2·6	10·5	6·8	6·4	16·9
Magnesia	0·4	1·4	0·9	0·4	3·1
Silica	80·0	73·5	81·6	82·2	2·1
Alumina	0·1	2·8			
Oxide of Iron	trace	0·2	2·6	0·9	2·3
Oxide of Manganese	trace	0·3			
Phosphoric Acid	0·2	3·5	4·8	1·8	9·9
Sulphuric Acid	1.4	2·2	1·0	6·1	13·3
Chlorine	0·1	1·3	0·9	0·6	11·4
Carbonic Acid	—	—	—	—	11·0
	100	100	100	100	100

The most striking differences in the above table are the comparatively large quantity of potash in the oat straw; of lime in that of barley; of phosphoric acid in that of wheat; of sulphuric acid in that of rye, and of all the saline substances in rape straw. These differences are not to be considered as constant, nor will the numbers in any of the above columns represent correctly the composition of the ash of any variety of straw we may happen to burn, but they may be safely depended upon as showing the general composition of such ashes, as well as the general differences which may be expected to prevail among them.

That such ashes should prove useful to vegetation might be inferred, not only from their containing many saline substances which are known to act beneficially when applied to the land, but from the fact that they have actually been obtained from vegetable substances. If inorganic matter be necessary to the growth of wheat, then surely the mixture of such matters contained in the ash of wheat straw is more likely than any other we can apply to promote the growth of the young wheat plant. A question might even be raised whether or not, in some soils rich in vegetable matter, the ash alone would not produce as visible an effect upon the coming crop as the direct application of the straw, either in the dry state, or in the form of rotted farmyard manure; and this question would seem to be answered in the affirmative by the result of many trials of straw ashes which have been made in England. In that country the ash of five tons of straw has been found superior in efficacy to ten tons of farmyard manure. This is perfectly consistent with theory; yet, as vegetable matter appears really essential to a fertile soil, and as the quantity of this vegetable matter is lessened in some degree by every corn crop we raise, it cannot be good husbandry to manure for a succession of rotations with saline substances only. The richest soil by this procedure must ultimately be exhausted. On the other hand, where much vegetable matter exists, and especially what is usually called *inert* vegetable matter, it may be an evidence of great skill in the practical farmer to apply, *for a time*, the ashes only of his straw, or some other saline mixture to his land.

The practice of burning the stubble on a windy day has been found in Yorkshire to produce better clover, and to cause a larger return of wheat: for this purpose, however, the stubble must be left of considerable length. In Germany, rape straw—which the above table shows to be so rich in saline and earthy matter, and therefore exhausting to the land—is spread over the field and burned in a similar manner. The destruction of weeds and insects which attends this practice is mentioned as one of its collateral advantages.

It is not advisable, as I have already said, wholly to substitute the ash for the straw in ordinary soils, or in any soils for a length of time; yet that it may be partially so substituted with good effect, or that straw ashes will alone give a large increase of the corn crop, and therefore should never be wasted, is shown by the following comparative experiments, conducted, as such experiments should be, during an entire rotation of four years. The quantity of manure applied, and the produce per imperial acre were as follows:

	No Manure.	15 cwt barley straw burned on the ground.	3 tons stable dung in the straw state.	3 tons of rotten dung 8 months old.
1°. Turnips	22 lbs.	$8\frac{1}{2}$ cwt.	$18\frac{3}{4}$ cwt.	$16\frac{1}{8}$ cwt.
2°. Barley	$14\frac{3}{4}$ bush.	$30\frac{3}{4}$ bush.	$30\frac{1}{2}$ bush.	$36\frac{3}{4}$ bush.
3°. Clover	8 cwt.	18 cwt.	20 cwt.	21 cwt.
4°. Oats.	32 bush.	18 bush.	38 bush.	40 bush.

The kind of soil on which this experiment was made is not stated, but it appears to show, as we should expect, that the effects of straw ash are particularly exerted in promoting the growth of the corn plants and grasses which contain much siliceous matter in their stems; in short, of plants similar to those from which the ash has been derived.

Theory of the action of Straw Ash.—That it should especially promote the growth of such plants appears most natural if we consider only the source from which it has been obtained, but it is fully explained by a farther chemical examination of the ash itself. The soluble matter of wood ash, *in general*, contains but a small quantity of silica, while that part of the straw ash which is taken up by water contains very much. Thus a wheat ash, analyzed by Berthier, contained of

	per cent.
Soluble salts . . .	19
Insoluble matter . . .	81
	100

and that which was dissolved by water consisted of

	per cent.
Silica	35
Chlorine	13
Potash and soda . . .	50
Sulphuric acid	2
	100

So that it was a mixture of *soluble* silicates and chlorides with a little sulphate of potash and soda. These soluble silicates will find an easy admission into the roots of plants, and will readily supply to the young stems of the corn plants and grasses the silica which is indispensable to their healthy growth.

Turf or peat ashes, obtained by the burning of peat of various qualities, are also applied with advantage to the land in many districts. They consist of a mixture in which gypsum is usually the predominating useful ingredient, the alkaline salts being present in very small proportion. The following table exhibits the composition of some varieties of ashes from the peat of Holland and from the heath of Luneburg, examined by Sprengel:

	Dutch Ashes (gray).			Luneburg Ashes (reddish).	
	Best quality.	Inferior quality.	Worst quality.	Good quality.	Producing little effect.
Silica . . .	47·1	55·9	70·4	31·7	43·3
Alumina . .	4·5	3·5	4·1	5·1	9·7
Oxide of Iron .	6·6	5·4	4·1	17·7	9·3
Do of Manganese	1·0	4·3	0·2	0·5	3·5
Lime . . .	13·6	8·6	6·1	31·9	7·1
Magnesia . .	4·9	1·6	3·9	1·0	4·6
Potash . .	0·2	0·2	0·1	0·1	—
Soda . . .	1·0	3·9	0·4	0·1	—
Sulphuric Acid .	7·2	6·4	3·4	6·2	Gypsum 0·2
Phosphoric Acid	2·0	0·8	1·3	1·2	Phos. of Lime 0·2
Chlorine . .	1·2	3·0	0·5	0·1	Common Salt 0·1
Carbonic Acid .	4·1	6·4	5·5	4·4	12·0
Charred Turf .	6·6	—	—	—	—
	100·0	100·0	100·0	100·0	100·0

In the most useful varieties of these ashes it appears, from the above analyses, that lime abounds, partly in combination with sulphuric and phosphoric acids, forming gypsum and phosphate of lime, and partly with carbonic acid, forming carbonate. These compounds of lime, therefore, may be regarded as the active ingredients of peat ashes.

Yet the small quantity of saline matter they contain is not to be considered as wholly without effect; for the ashes are often applied to the land to the extent of two tons an acre, a quantity which, even when the proportion of alkali does not exceed one per cent., will contain 45 lbs. of potash or soda, equal to twice that weight of sulphates or of common salt. To the minute quantity of saline matters present in them, therefore, peat ashes may owe a portion of their beneficial influence, and to the almost total absence of such compounds from the less valuable sorts their inferior estimation may have in part arisen.

In Holland, when applied to the corn crops, they are either ploughed in, drilled with the seed, or applied as a top-dressing to the young shoots in autumn or spring. Lucern, clover, and meadow grass are dressed with it in spring at the rate of 15 to 18 cwt. per acre, and the latter a second time with an equal quantity after the first cutting. In Belgium the ashes are applied to clover, rape, potatoes, flax, and pease. In Luneburg, the turf ash which abounds in oxide of iron is applied at the rate of 3 or 4 tons per acre, and by this means the physical character of the clay soils, as well as their chemical constitution, is altered and improved.

In England peat is in many places burned for the sake of the ashes it yields. The soil from beneath which the turf is taken abounds in lime, and the ashes are said to contain from one fourth to one third of their weight of gypsum. They are used largely both in Berkshire and Hampshire, and are chiefly applied to green crops, and especially to clover, at the rate of 50 bushels.

Coal ashes are a mixture of which the composition is very variable; they consist, however, in general, of lime, often in the state of gypsum, of silica, and of alumina, mixed with a quantity of bulky and porous cinders or half-burned coal. The ash of a coal from St. Etienne, in France, after all the carbonaceous matter had been burned away, was found by Berthier to consist of

	per cent.
Alumina, insoluble in acids	62
Alumina, soluble	5
Lime	6
Magnesia	8
Oxide of Manganese	3
Oxide and Sulphuret of Iron	16
	100

Such a mixture as this would no doubt benefit many soils by the alumina, as well as by the lime and magnesia it contains; but in coal ashes a small quantity of alkaline matter, chiefly soda, is generally present. The constitution of the ash of our best coals, therefore, may be considered as very nearly resembling that of peat ash, and as susceptible of similar applications. When well burned, it can, in many cases, be applied with good effects as a top-dressing to grass lands which are overgrown with moss, while the admixture of cinders in the ash of the less perfectly burned coal produces a favourable physical change upon strong clay soils.

Cane Ashes.—I may allude here to the advantage which in sugar-growing countries may be obtained from the restoration of the cane ash to the fields in which the canes have grown. After the canes have been crushed in the mill, they are usually employed as fuel in boiling down the sirup, and the ash, which is not unfrequently more or less melted, is, I believe, almost uniformly neglected; at all events, is seldom applied again to the land. According to the principles I have so often illustrated in the present lectures, such procedure must sooner or later exhaust the soil of those saline substances which are most essential to the growth of the cane plant. If the ash were applied as a top-dressing to the young canes, or put into the cane holes near the roots—having been previously mixed with a quantity of wood ash, and crushed if it happen to have been melted—this exhaustion would necessarily take place much more slowly.—(*Johnson.*)

ASILUS. A Linnæan genus of dipterous insects, in which the mouth is furnished with a horny, projecting, straight, two-valved sucker, and gibbous at the base: antennæ filiform, approximate, of two articulations; body oblong and conical in shape. The insects of this genus prey on other insects, especially those of the dipterous and lepidopterous orders.

ASPARAGIN. The white crystalline principle found in the juice of the asparagus, supposed to be a diuretic. It is resolved, by boiling in water with magnesia, into ammonia and *aspartic acid.*

ASPARAGUS. *Asparagus officinalis.* A perennial plant growing on sandy meadows near the sea. The young shoots (*torus*) form an esteemed vegetable, and are susceptible of high cultivation. They may be raised from roots or seed. The seed is sown in April, in rich soil an inch deep, in rows eighteen inches apart, and the ground kept clean. In two or three seasons the roots will be large enough to transplant to permanent beds. The new plantation is made in March or April; the ground must be light, deep, and rich, and well dug. The beds are made six feet wide, with alleys of two feet between them; three rows of root-stools are placed in each bed, at the depth of six inches and distance of a foot. Every spring the bed is forked or loosened, and a dressing of well-rotted stable manure mixed with the upper soil. The roots send up abundant shoots when kept moist with water during the season, if sufficient rain does not fall. A sprinkling of salt with the manure is a very great improvement. Indeed, in Spain, asparagus is cultivated in beds subject to inundations of the sea. All animal manures increase the growth. To enlarge the size of the shoot, they place, in Germany, small flower pots or other tubular vessels over the earth as soon as the shoot appears; it grows into these, and, being deprived of light, remains white and tender, attaining the size of the vessel in some cases. Sixteen rods of bed will yield 200 to 300 heads a day during the season. The beds last, with management, a long term of years; indeed, some are known forty years old.

To force Asparagus.—Such plants must be inserted in hot-beds as are five or six years old, and appear of sufficient strength to produce vigorous shoots; when, however, any old natural ground plantations are intended to be broken up at the proper season, some of the best plants may be selected to be plunged into a hot-bed, or any spare corner of the stove bark-beds. The first plantation for forcing should be made about the latter end of September: the bed, if it works favourably, will begin to produce in the course of four or five weeks, and will continue to do so for about three, each light producing in that time 300 or 400 shoots, and affording a gathering every two or three days. To have a regular succession, therefore, a fresh bed must be formed every three or four weeks, the last crop to be planted in March or the early part of April: this will continue in production until the arrival of the natural ground crops. The last-made beds will be in production a fortnight sooner than those made about Christmas.

The bed must be substantial, and proportioned to the size and number of the lights, and to the time of year, being constructed of stable dung or other material. The common mode of making a hot-bed is usually followed. It is the best practice to plant the asparagus in mould laid upon the tan, which, or some other porous matter, is indispensable for the easy admission of the heat from the linings. The bed must be topped with six or eight inches of light, rich earth. If a small family is to be supplied, three or four lights will be sufficient at a time; for a larger, six or eight will not be too many. Several hundred plants may be inserted under each, as they may be crowded as close as possible together; from 500 to 900 are capable of being inserted under a three-light frame, according to their size. In planting, a furrow being drawn the whole length of the frame, against one side of it the first row or course is to be placed, the crowns upright, and a little earth drawn on to the lower ends of the roots; then more plants again in the same manner, and so continued throughout, it being carefully observed to keep them all regularly about an inch below the surface: all round on the edge of the bed some moist earth must be banked close to the outside roots.

If the bed is extensive, it will probably acquire a violent heat; the frames must therefore be continued off until it has become regular, otherwise the roots are liable to be destroyed by being, as it is technically termed, *scorched* or *steam-scalded.* When the heat has become regular, the frames may be set on, and more earth be applied, by degrees, over the crowns of the plants, until it acquires a total depth of five or six inches. The glasses must be kept open an inch or two as long and as often as possible, without too great a reduction of temperature occurring, so as to admit air freely and give vent to the vapours, for on this depends the superiority in flavour and appearance of the shoots. The heat must be kept up by linings of hot dung, and by covering the glasses every night with mats, &c. The temperature at night should never be below 50°, and in the day its maximum at 62°. In gathering, for which the shoots are fit when from two to five inches in height, the finger and thumb must be thrust down into the earth, and the stem broken off at the bottom. This excellent vegetable possesses some diuretic properties. Its juice contains a peculiar crystallizable substance, which was discovered by Vauquelin and Robiquet, and named by them *Asparagin.*

ASPARAGUS STONE. A variety of apatite. See *Apatite.*

ASPEN. *Populus tremula* and *tremuloides*, species of the great genus of poplars, remarkable for their lightness and shade. The timber is white, soft, and readily decays.

ASPERGILLUM. One of the commonest mildew plants. See *Mildew.*

ASPIDIOTUS. A genus of insects resembling the bark-lice, or scale insects, and of the same habits and family. They are found on the oleander, rose, bay, cactus, and other plants.

ASPHODELEÆ. The family of plants to which the onion belongs.

ASS. A well-known and useful domestic animal, whose services might be rendered even still more useful for various purposes of husbandry if he were properly trained and taken care of.

He is extremely hardy, both with regard to the quantity and quality of his food, contenting himself with the most harsh and disagreeable herbs, which other animals will scarcely touch. In the choice of water he is, however, very nice, drinking only of that which is perfectly clear, and at brooks with which he is acquainted.

Animals of this sort require very little looking after, and sustain labour, hunger, and thirst beyond most others. They are seldom or never sick, and endure longer than most other kinds of animals. They may be made useful in husbandry to plough light lands, to carry burdens, to draw in mills, to fetch water, cut chaff, or any other similar purposes. They are also very serviceable in many cases for their milk, which is excellent for those who have suffered from acute diseases, and are much weakened. They are used for the purpose of breeding mules.

The structural difference between the horse and the ass is trifling: in all essential points the organization is the same; and, with the exception of the lengthened ears of the ass, their form, size, and proportions in a wild state, they differ but little; consequently, they possess conditions more favourable to the multiplication of species than those afforded by any other nearly allied animals. The ass is, properly speaking, a mountain animal: his hoofs are long, and furnished with extremely sharp rims, leaving a hollow in the centre, by which means he is enabled to tread with more security on the slippery and precipitous sides of hills and precipices. The hoof of the horse, on the contrary, is round, and nearly flat underneath, and we accordingly find that he is most serviceable in level countries; and, indeed, experience has taught us that he is altogether unfitted for crossing rocky and steep mountains. As, however, the more diminutive size of the ass rendered him comparatively less important as a beast of burden, the ingenuity of mankind early devised a means of remedying this defect, by crossing the horse and ass, and thus procuring an intermediate animal, uniting the size and strength of the one with the patience, intelligence, and surefootedness of the other.

The varieties of the ass, in countries favourable to their development, are great. In Guinea the asses are large, and in shape even excel the native horses. The asses of Arabia (says Chardin) are perhaps the handsomest animals in the world. Their coat is smooth and clean; they carry the head elevated, and have fine and well-formed legs, which they throw out gracefully in walking or galloping. In Persia, also, they are finely formed, some being even stately, and much used in draught and carrying burdens, while others are more lightly proportioned, and used for the saddle by persons of quality, frequently fetching the large sum of 400 livres, and, being taught a kind of easy, ambling pace, are richly caparisoned, and used only by the rich and luxurious nobles. With us, on the contrary, the ass, unfortunately, exhibits a stunted growth, and appears rather to vegetate as a sickly exotic than to riot in the luxuriant enjoyment of life like the horse.

The diseases of the ass, as far as they are known, bear a general resemblance to those of the horse. As he is more exposed, however, and left to live in a state more approaching to that which nature intended, he has few diseases —(*Johnson.*)

ASTRINGENT. In farriery, a term applied to such remedies as have the property of constringing, or binding the parts, as oak bark, sugar of lead, &c.

ATMOSPHERE. The bulk of air which surrounds our globe, supposed to reach forty-five miles above its surface. It is the receptacle of every volatile substance rising from the earth; but, in virtue of its peculiar composition, vapours and gases diffuse themselves throughout the mass with great rapidity, so that the composition of the whole is maintained nearly uniform at all times and places. Its chemical composition is 79 parts nitrogen, 20 8 oxygen, 4 to 6 parts in ten thousand of carbonic acid, about one part in sixty thousand of ammonia, according to Liebig, besides minute quantities of various vapours, microscopic seeds, and saline matters. Water, in the form of vapour, is also an important constituent, fluctuating in quantity with the temperature of the air, and increasing as the warmth. In the development of plants the air is as important as the earth. indeed more so, since many vegetables can live suspended, without contact with the earth, while none can exist without a full supply of air. The loosening of soils is in a great measure beneficial from the introduction of air. The various ingredients enumerated have not an equal importance in agriculture; for the nitrogen is almost inactive: the oxygen is the great agent of destruction as regards plants, causing the decomposition of all vegetable structures; the carbonic acid and ammonia are the great sources of food, and although they are present in minute proportions, they are abundantly distributed for the purposes of vegetation. For the history of these gases, see them severally.

ATOM. In chemistry, the ultimate particle of a body, which combines with other atoms. Theoretically, these are of a determinate magnitude in every case. The figure of the atom is not worthy of consideration, some supposing it spherical, others elipsoidal. Atoms are simple or elementary when they cannot be separated by chemical forces, and compound when they are liable to decomposition. Chemical compounds consist of a definite number of atoms, bound together by chemical force or affinity; but the value of this force is different in different compounds. In consequence, however, of the union of atoms in invariable weights, determined by experiment, each chemical body has attached to it a distinct proportional weight, termed its *atomic weight*, *equivalent*, or *combining number*. The study of these is the essential of all chemical inquiries: it is this remarkable adherence to a precise weight in all cases of combination which gives exactness to our investigations, and forms the difference between a mere mixture and chemical union. The following are the atomic weights or proportionals of the various elementary bodies interesting to agriculture:

Hydrogen (H.)	1·
Oxygen (O.)	8·
Nitrogen (N.)	14·
Carbon (C.)	6·
Sulphur (S.)	16·
Phosphorus (P.)	31·
Chlorine (Cl.)	35·5
Silicon (Si.)	22·
Potassium (K.)	39·
Sodium (Na.)	23·
Calcium (Ca.)	20·5
Magnesium (Mg.)	12·7
Aluminium (Al.)	13·7
Iron (Fe.)	27·
Manganese (Mn.)	27·7

These are on the basis that hydrogen is 1·, and may be understood by the following case: Water is a compound of one atom of hydrogen and one atom of oxygen; and, supposing a given quantity weighs nine grains, we know, by the laws of chemical combinations, that it contains one grain of hydrogen and eight grains of oxygen; or, if the weight of water be other than nine grains, these constituents are united in the rigorous proportion of 1 to 8.

Another scale is constructed on the basis of oxygen as 100. In this the equivalent numbers are altered, but not their proportions.

Chemical combinations are not, however, always in the simple ratio of one atom of each component, but are often in higher ratio, as 1 to 2, 3, 4, 5, 6, 7, or 2 to 3, 5, 7, &c. These are, for the most part, less permanent than the simpler compounds.

The atomic weight is not only fixed for the first product of two elementary bodies, but for all other secondary, tertiary, or quaternary compounds resulting therefrom. Thus, ammonia consists of one atom nitrogen (14) and three atoms of hydrogen (3), and its equivalent is therefore 17. Being a strong alkali, it combines with many substances, and always in the proportion of 17.

In the above table, the letters in parentheses designate the signs or symbols used in chemistry for the various bodies against which they are set. Whenever any of them are used alone it always means one atom: thus, N, C, H, mean one atom of nitrogen, carbon, hydrogen. In complicated bodies, as oxalic acid, a formula is written with the symbols, and numbers set against each to designate the number of atoms, thus: (HO, $C_2\,O_3$); or, sometimes, ($H+O$, $2\,C+3\,O$), the parentheses indicating an intimate union; or one of the components of a complex body, thus: $(2\,C+3\,O)+(Ca+O)+2\,(H+O)$ means a compound consisting of oxalic acid, which is the first term, united to lime, which is the second, united to two atoms of water, which is the last term, the whole formula representing the exact composition of oxalate of lime. Whenever the parentheses enclose a formula, and any figures are placed without it, the figure represents the number of atoms of the compound, thus: $(S+3\,O)$ is sulphuric acid; $2\,(S+3\,O)$ is two atoms of sulphuric acid; $3\,(S+3\,O)$ three atoms, &c. The use of symbols greatly reduces the labour of writing and reading chemical processes.

ATOMIC THEORY. The theory of Dr. Dalton, that chemical union takes place only in definite atoms. See *Atom*.

ATOMIC WEIGHT. The equivalent or combining weight. See *Atom*.

ATROPIA. The poisonous alkaloid of the deadly night-shade.

ATROPHY. In farriery, a morbid wasting and emaciation, attended with a great loss of strength in animals.

ATTRACTION. In physics, the force which draws bodies together; it is usually, if not always, of electrical origin. Attraction is divided into mechanical, as gravity and cohesion; and chemical, as affinity; the first being the force tending to unite masses and similar particles, the latter the force producing chemical union. In chemistry it is so far supposed to be an electrical effect, that one of the atoms or groups of every compound is supposed to be in an opposite state of electricity from the other, and they are respectively termed the electro-negative and electro-positive elements or components. Acids, oxygen, chlorine, are electro-negative bodies; metallic oxides electro-positive. Chemical attraction acts only at insensible distances, and is assisted by heat, solution, and minute division; it is, indeed, frequently destroyed by the hardness and insolubility, as well as gaseous form, of bodies.

AUCHENIA. The region of the neck, in mammals, below the nape.

AUGER, BORING. An implement for boring into the soil. An auger of the above kind, when made of a large size, and with different pieces to fix on to each other, may be very usefully applied to try the nature of the under soil, the discovering springs, and drawing off water from lands, &c. In order to accomplish the first purpose, three augers will be necessary: the first of them about three feet long, the second six, and the third ten. Their diameters should be near an inch, and their bits large, and capable of bringing up part of the soil they pierce. An iron handle should be fixed crossways to wring it into the earth, from whence the instrument must be drawn up as often as it has pierced a new depth of about six inches, in order to cleanse the bit and examine the soil.—(*Johnson.*)

AUGER, DRAINING. An instrument employed for the purpose of boring into the bottoms of drains or other places, in order to discover and let off water. It is nearly similar to that made use of in searching for coal or other subterraneous minerals. The auger, shell, or wimble, as it is variously called, for excavating the earth or strata through which it passes, is generally from two and a half to three and a half inches in diameter; the hollow part of it is one foot four inches in length, and constructed nearly in the shape of the wimble used by carpenters, only the sides of the shell come closer to one another. The rods are made in separate pieces of four feet long each, that screw into one another to any assignable length, one after another, as the depth of the hole requires. The size above the auger is about an inch square, unless at the joints, where, for the sake of strength, they are a quarter of an inch more.

There is also a chisel and punch, adapted for screwing on, in going through hard gravel or other metallic substances, to accelerate the passage of the auger, which could not otherwise perforate such hard bodies. The punch is often used, when the auger is not applied, to prick or open the sand or gravel, and give a more easy issue to the water. The chisel is an inch and a half or two inches broad at the point, and made very sharp for cutting stone; and the punch an inch square, like the other part of the rods, with the point sharpened also.

As it is remarked by Johnstone, in his account of Elkington's mode of draining, to judge when to make use of the borer is a difficult part of the business of draining. Many who have not seen it made use of in draining have been led into a mistaken notion, both as to the manner of using it and the purposes for which it is applied. They think that if, by boring indiscriminately through the ground to be drained, water is found near enough to the surface to be reached by the depth of the drain, the proper direction for it is along these holes where water has been found, and thus make it the first implement that is used. The contrary, however, in practice, is the case, and the auger is never used till after the drain is cut, and then for the purpose of perforating any retentive or impervious stratum lying between the bottom of the drain and the reservoir or strata containing the spring. Thus it greatly lessens the trouble and expense that would otherwise be requisite in cutting the trench to that depth to which, in many instances, the level of the outlet will not admit. The manner of using it is simply thus: In working it, two, or, rather, three men are necessary; two stand above, on each side of the drain, who turn it round by means of the wooden handles, and when the auger is full they draw it out; and the man in the bottom of the trench clears out the earth, assists in pulling it out, and directing it into the hole; and he can also assist in turning with the iron handle or key, when the depth and length of rods require additional force to perform the operation. The workmen should be cautious, in boring, not to go deeper at a time, without drawing, than the exact length of the shell, otherwise the earth, clay, or sand through which it is boring, after the shell is full, makes it very difficult to pull out. For this purpose, the exact length of the shell should be regularly marked on the rods, from the bottom upward. Two flat boards, with a hole cut into the side of one of them, and laid alongside of one another over the drain in the time of boring, are very useful for directing the rods in going down perpendicularly, for keeping them steady in boring, and for the men standing on when performing the operation.

AUGUST. In this month the stacking of hay and other crops harvested is to be attended to. Root crops have been laid up, and the land cleared of weeds. Turnips for an after crop may be sown, if the weather be not too dry. Budding may be done with advantage. Preparations are to be made for collecting cotton. The tobacco crop begins to ripen by the end of the month. Rice is cut.

AURELIA, AURELIAN. The pupa or nymph of the higher insects.

AURICLE. The external ear. The venous chambers of the heart.

AURICULAR. Appertaining to the ear.

AURICULATE. When the base of a leaf is lobed on each side the midrib.

AUSCULTATION. The examination of the sounds within the body to detect diseases, &c.

AUTOPSY. Examination by the eye. It is generally used to designate examinations of the body after death, for the discovery of the causes of disease.

AVENA. The generic name of a family of grasses, of which the *A. sativa*, oats, and *A. elatior*, Andes grass, are best known. Several species, as the *A. flavescens* and *pubescens*, are found in English meadows, and the latter is well worthy of cultivation; it is the *downy oat grass* of agriculturists.

AVENUE. Any broad, gravelled, or properly-made road, bordered by trees. A side road, or approach to a house.

AVERRUNCATOR. In arboriculture, an instrument for cutting off the branches of trees, consisting of two blades fixed on the end of a rod, one of which has a moveable joint, which, by means of a line fixed to it, operates like a pair of scissors. In the improved forms of this instrument, the point on which the moving or cutting blade turns, instead of being confined to a circular opening, works in a longitudinal one; in consequence of which, instead of a crushing cut, like that produced by common hedge shears, a draw cut is formed, which leaves the section from which the branch or shoot has been amputated as clean as that produced by a pruning knife.

AVERSE, AVERSUS. Turned back.

AVES. See *Ornithology*.

AVIARY. A place to keep birds in. Green-houses are usually selected.

AVOIRDUPOIS. A weight having sixteen ounces to the pound, in distinction to Troy weight, which has only twelve. The following is a tabular view of this weight:

16 drams make	1 ounce.
16 ounces	1 pound.
28 pounds	1 quarter.
4 quarters	1 cwt.
20 cwt.	1 ton.

drs.	*ozs.*				
16=	1=	*lbs*			
256=	16=	1	*qrs.*		
7,168=	448=	28=	1=	*cwt.*	
28,672=	1,792=	112=	4=	1	*ton.*
573,440=	35,840=	2240=	80=	20=	1

5760 Troy grains make 1 pound Troy, and 7000 Troy grains 1 pound Avoirdupois; hence 175 pounds Troy are equal to 144 pounds Avoirdupois.

AWN. The stiff beard or bristle of some grasses, *arista*.

AWNING. A covering of some kind of cloth, to protect plants, &c., from sun or rain.

AXIL, AXILLA. The armpit. The angle between a leaf and the stem. Buds placed here are termed axillary.

AXIS, AXLE-TREE. The spindle or central rod around which parts of machinery, &c., revolve or are developed.

AZALEA. A genus of small ornamental shrubs with large, trumpet-shaped flowers, of the family of the honeysuckles.

AZOREAN FENNEL. *Anethum azoricum.* A kind of fennel

AZOTE. Nitrogen.

B.

BACCA. A berry.

BACCIFEROUS. Bearing berries, as the currant.

BACK. The spine. The back of a horse should be straight, in order that it may be strong; when it is hollow, or what is termed *backed*, the animal is generally weak.

BACK, SORE. A complaint which is very common to young horses when they first travel. To prevent it, their backs should be cooled every time they are baited, and now and then washed with warm water and wiped dry with a linen cloth. The best cure for a sore back is a lotion of 1 drachm of sugar of lead with 1 pint of vinegar and water.

BACK SINEWS, SPRAIN OF THE. This is often occasioned by the horse being overweighted, and then ridden far and fast, especially if his pasterns are long; but it may occur from a false step, or from the heels of the shoes being too much lowered. Sprain of the back sinews is detected by swelling and heat at the back of the lower part of the leg, puffiness along the course of the sinews, extreme tenderness so far as the swelling and heat extend, and very great lameness.

The first object is to abate the inflammation, and this should be attempted by bleeding from the plate vein, by means of which blood is drained from the inflamed part; next, local applications should be made to the back of the leg, in the form of fomentations of water, sufficiently hot, and frequently repeated; at the same time, as much strain as possible should be taken from the sinew, by putting a high calkin on the heel of the shoe.

BACK-RAKING. An operation in farriery, by which hardened fæces are withdrawn from the rectum.

BACON. See *Hog*.

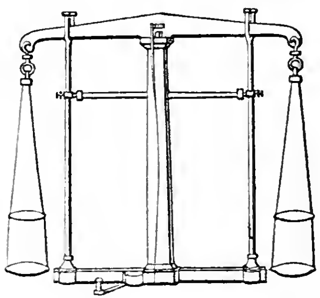
BAGGING. A mode of reaping corn or pulse with a hook, in which the operator effects his object by striking the straw, or haulm, instead of drawing the hook through it; in other words, it is separating the straw, or haulm, from the root by chopping, instead of by a drawing cut.

BAKING OF LAND. Clayey lands, when ploughed wet, become incrusted or baked: seed cannot break through the crust, and should be again sown.

BALANCE FOR ANALYSIS. This important instrument may be considered as consisting of an inflexible rod, or lever, called the beam, furnished with three axes: one, the fulcrum or centre of motion, situated in the middle, upon which the beam turns, and the other two near the extremities, and at equal distances from the middle; these last are called the points of support, and serve to sustain the pans or scales. The points of support and the fulcrum should be in the same right line. The arms of the lever being equal, it follows that, if equal weights be put into the scales, no effect will be produced on the position of the balance, and the beam will remain horizontal.

If a small addition be made to the weight in one of the scales, the horizontality of the beam will be disturbed, and after oscillating for some time, it will, on attaining a state of rest, form an angle with the horizon, the extent of which is a measure of the delicacy or sensibility of the balance.

What we have now stated will serve to illustrate the principle of the balance. Its mode of construction will be best understood by a diagram:



One of the best form is here represented. The parts are all so arranged that it can, at pleasure, be lifted off the points of support. This is effected by aid of the two uprights, which are elevated by a small lever at the bottom. The scale pans are made of brass or platina.

In order to try the goodness of a pair of scales, the scales should be taken off the beam to ascertain if the beam balances without them; they should then be put on again and afterward reversed, or each scale hung on the end of the beam opposite that which it before occupied. Equal weights should then be put into the opposite scales, and these should, in like manner, be reversed or changed; and if the beam maintains its horizontal position under all these changes, it may be relied on as being good and perfect. The pivots or fulcrum upon which the beam turns ought to be sharp, or knife-edged, as it is termed, and they should be of steel well hardened, as well as the interior of the ring in which they move: this confines the fulcrum to a minute line, and prevents friction. In beams for nice purposes, the pivots ought not to be too much elevated above the centre of gravity; for, although this centre will generally be found an inch or two below the pivots in strong warehouse beams, in order to bring them to a speedy equilibrium, by which time is saved, yet, for accurate weighing, the nearer the centre of gravity is brought into the straight line that would connect the tops of the two scale eyes and the under side of the pivot the better, although such a beam will occasion great loss of time by its vibrating a long time before it becomes stationary.

BALL, or BOLUS. In farriery, a well-known form of medicine for horses or other animals, which may be passed at once into the stomach. They should be made of a long, oval shape, and about the size of a small egg, being best conveyed over the root of the tongue by the hand. This method of administering medicines is preferable, in most cases, to that of drenches. I subjoin the recipes for a few of those balls most commonly used by the farmer:

Mild Physic Ball.

Barbadoes aloes . .	6 drachms.
Powdered ginger . .	2 "
Castile soap . . .	2 "
Oil of cloves . . .	20 drops.

Sirup of buckthorn sufficient to form a ball.

Strong Physic Ball.

Barbadoes aloes . .	8 drachms.
Ginger, powdered .	2 "
Castile soap . . .	2 "
Oil of cloves . . .	20 drops.

Sirup of buckthorn sufficient to form a ball.

Calomel Ball for a Horse.

Calomel	1 drachm.
Aloes, powdered . .	6 "
Ginger, powdered .	2 "
Castile soap . . .	2 "
Oil of Cloves . . .	20 drops.

Sirup of buckthorn sufficient to make into a ball.

Diuretic Ball.

Castile soap	4 ounces.
Nitre, powdered . .	2 "
Spirit of turpentine .	4 "

Anise seed powder and treacle sufficient to make into eight balls.

Cordial Ball.

Cummin seed, powdered	4 ounces.
Anise seed, powdered .	4 "
Caraway seed, powdered	4 "
Ginger, powdered . .	2 "

Honey sufficient to make into balls the size of a hen's egg.

BALM. The plant *Melissa officinalis*, of a pleasant aromatic odour; its medicinal virtues are trifling.

BALSAMS. Exudations from certain trees of a resinous nature.

BANANA. A tall herbaceous, endogenous plant, the *Musa sapientum* of botanists, having broad convex leaves with fine oblique veins, and growing in a tuft from the top of a stem formed by the union of the broad bases of the leaves. The fruit ripens in succession in large clusters weighing many pounds. It is of the same nature as the plantain. It is a native of the West Indies, where it contributes essentially to the food of all classes.

BANKS OF RIVERS. See *Embankment*.

BANNER, VEXILLUM. The upper petal of pea flowers.

BARB. A general name for horses imported from Barbary. The barb, one of the most celebrated of the African racers, is to be met with throughout Barbary, Morocco, Fez, Tripoli, and Bornou. It seldom exceeds fourteen hands and a half in height. The countenance of the barb is usually indicative of its spirit, and the facial line, in direct contradiction to that of the Arabian, is often slightly rounded; the eyes are prominent; the ears, though frequently small and pointed, are occasionally rather long and drooping; the neck is of sufficient length; the crest is generally fine and not overladen with mane; the shoulders are flat and oblique; the withers prominent, and the chest almost invariably deep; the back is usually straight; the carcass moderately rounded only; the croup long, and the tail placed rather high; the arms and thighs being commonly muscular and strongly marked; the knee and hock are broad and low placed; the back sinews singularly distinct and well marked from the knee downward; the pasterns rather long, and the feet firm, and but moderately open.

The barb requires more excitement to call out his powers than the Arabian; but when sufficiently stimulated, his qualities of speed and endurance render him a powerful antagonist, while the superior strength of his fore hand enables him to carry the greater weight of the two. The Godolphin barb, which was imported from France into England at the conclusion of the last century, about 25 years after the Darley Arabian, was one of those most worthy of note. The former appears to have rivalled the latter in the importance of his get. He was the sire of Lath, Cade, Babraham, Regulus, Bajazet, Tarquin, Dormouse, Sultan, Blank, Dismal, and many other horses of racing note; and, without doubt, the English blood-breeds were more indebted to the Darley Arabian and the Godolphin barb than to all the other Eastern horses which had previously entered the country.—(*Blaine's Encyc. Rural Sports*, p. 243.)

BARBERRY BUSH. *Berberis vulgaris.* An indigenous thorny shrub, bearing bunches of pale yellow drooping flowers in May, which are succeeded by oblong scarlet berries, ripening in September. Sharp, three-cleft thorns rise at the base of each leaf-bud. The barberry makes good hedges. It may be propagated by seed, or by layers, which should remain two years before they are removed. The gross shoots, if the shrub stands singly, should be pruned away, and it will fruit better. The berries are gratefully acid, and the juice, when diluted with water, may be used as lemonade in fevers. The fruit, made into conserve, is good. It is also excellent as a pickle and preserve.

There is no good reason for supposing that this bush produces mildew in wheat. It is very liable to rubigo, a parasitical fungus, but not the uredo of grain. The root contains a good yellow dye, and is emetic.

BARILLA. The ashes of sea-shore plants, containing about 20 per cent. of soda. The cheap manufacture of soda has nearly destroyed the cultivation of barilla plants. It is used to manufacture hard soaps. See *Soda*.

BARK. The rind or covering of the woody parts of a tree. The bark of trees is composed of three distinct layers, of which the outermost is called the *epidermis*, the next the *parenchyma*, and the innermost, or that in contact with the wood, the *cortical layer*. The epidermis is a thin, transparent, tough membrane; when rubbed off it is gradually reproduced, and in some trees it cracks and decays, and a fresh epidermis is formed, pushing outward the old: hence the reason why so many aged trees have a rough surface. The parenchyma is tender, succulent, and of a dark green. The cortical layer, or *liber*, consists of thin membranes encircling each other, and these seem to increase with the age of the plant. The liber, or inner bark, is known by its whiteness, great flexibility, toughness, and durability: the fibres in its structure are ligneous tubes. It is the part of the stem through which the juices descend, and the organ in which the generative sap, from whence all the other parts originate, is received from the leaves. The bark in its interstices contains cells, which are filled with juices of very varying qualities: some, like that of the oak, remarkable for their astringency; others, like the cinnamon, abounding with an essential oil; others, as the Jesuits' bark, containing an alkali; some mucilaginous, many resinous.

M. Saussure found in 100 parts of the ashes of the barks of various trees the following substances:

	Oak.	Hazel.	Poplar.	Mulberry.	Hornbeam.
Soluble salts .	7·	12·5	6·	7·	4·5
Earthy phosphates	3·	5·5	5·3	8 5	4·5
Earthy carbonates	66·	64·	60·	45·	59·
Silica	1·5	0·25	4·	15·12	1·5
Metallic oxides .	2·	1·75	1·5	1·12	0·12

From this analysis the farmer will see that the earthy and saline ingredients of the bark of forest trees must be considerable fertilizers: it is only to the slowness with which refuse tanner's bark undergoes putrefaction that its neglect by the cultivator must be attributed. It might certainly, however, be mixed with farm-yard compost with very considerable advantage; and in its half putrefied, or even fresh state, it produces on some grass lands very excellent effects as a top dressing; and in instances where carriage is an object, even its ashes would be found, from the quantity of earthy carbonates and phosphates which they contain, a very valuable manure.

The different uses of barks in tanning and dyeing are numerous and important. The strength or fineness of their fibres is also of consequence: thus woody fibres are often so tough as to form cordage, as exemplified in the bark of the lime, the willow, and the cocoanut; the liber of some trees, as, for example, the lime and the paper mulberry, is manufactured into mats; and it is scarcely requisite to refer to hemp and flax for spinning and weaving. The bark of the oak is used for affording tannic acid in the manufacture of leather. The following table of Davy will show the relative value of different kinds of bark to the tanner; it gives the quantity of tannic acid afforded by 480 lbs. of different barks in that chemist's experiments:

Average from the entire bark of	lbs.
Middle-sized oak, cut in spring . . .	29
————, cut in autumn . . .	21
Elm	13
Common willow (large)	11
Ash	16
Beech	10
Sycamore	11
Lombardy poplar	15
Birch	8
Blackthorn	16
White interior cortical layers of oak bark	72

The difference of seasons makes a considerable variation in the produce of tannic acid: it is the least in cold springs. The tannic acid most abounds when the buds are opening, and least in the winter; 4 or 5 lbs. of good oak bark, of average quality, are required to form 1 lb. of leather.

Cork is the bark of a species of oak (*Quercus suber*) which grows abundantly in the south of Europe.

The *Quercitron* bark is the production of black oak (*Quercus tinctoria*).

BARK CLEANING. Fruit-trees sometimes become infested with lichens or moss; the rough bark offers an asylum for grubs, eggs, and caterpillars, all which injure, and often destroy the tree. To prevent these, the bark should be scraped in the spring with an old hoe or cooper's knife, and afterward washed with strong lye, brine, whale oil soap dissolved in water (1 lb. to 3 gallons), lime-water, soft soap, &c.

BARK-BOUND. Trees, the bark of which appears stretched over the wood, and which does not split off kindly, are said to be bark-bound. Cutting a slit through it from the branches to the root relieves the tree, and, when the wound is kept clean from insects, does good. It should be done in March or April, when frosts are over.

BARKING IRONS. Instruments for removing the bark of oak and other trees. They consist of a blade or knife for cutting the bark, while yet on the trunk, across at regular distances, and of chisels or spatulæ, of different lengths and breadths, for separating the bark from the wood.

BARKING OF TREES. The operation of stripping off the bark or rind. It is common to perform the operation of oak-barking in the spring months, when the bark, by the rising of the sap, is easily separated from the wood. This renders it necessary to fell the trees in these months. The tool commonly made use of in most countries is made of bone or iron. If of the former, the thigh or shin bone is preferred, which is formed into a two-handed instrument for the stem and larger boughs, with a handle of wood fixed at the end. The edge being once given by the grinding stone, or a rasp, it keeps itself sharp by wear.

The cutters should be provided with ripping saws, widely set, with sharp, light hatchets, and with short-handled pruning hooks. The barkers are provided with light, short-handled ashen mallets, the head being about eight inches long, three inches diameter in the face, and the other end blunt, somewhat wedge-shaped; with sharp ashen wedges, somewhat spatula-shaped, and which may either be driven by the mallet, or, being formed with a kind of handle, may be pushed with the hand.

The large pieces are set up on end, or they are formed into small pyramidal stacks. Due attention must be paid to turning the bark according to the state of the weather. Good hay weather is good barking weather. It is chiefly by the high brown colour of the inner rind, and by its astringent effect upon the palate when tasted, that the tanner or merchant judges of its value. If these properties be lost through neglect, or by the vicissitudes of the weather, the inner bark becomes blanched, or rendered white.

After it is in a proper state, that is, completely past fermentation, if it cannot conveniently be carried off the ground and housed, it must be stacked. An experienced husbandman who can stack hay can also stack bark; but it may be proper to warn him against building his stack too large, and to caution him to cover it well.

BARK LICE. *Scale insects.* Insects of the genus *Coccus*, many of which yield a rich dye, as the *C. cacti*, or cochineal of Mexico. They are of an oval or roundish form, and small in size, rarely exceeding one fourth of an inch. They infest the young bark commonly, but are also found on the leaves and roots of some plants. The female undergoes no winged transformation, but the male does. In the spring the lice are found like dead shields on the young branches, arranged in rows; under these apparently inanimate bodies the eggs of a new generation are concealed, which shortly put on life, and come forth of the oval figure of the family; they insert their slender beaks into the young bark or leaves, and begin to draw the sap with such activity that it drops from them and the punctures to the ground, attracting ants to ascend the tree. After a season, the cocci attach themselves to some spot on the bark, and emit downy threads to make fast. Here a transformation ensues, which gives wings to the male, and only a new coat to the female. After a time, differing with the species, the male comes forth reduced in size, but the female is stationary. Impregnation ensues, her body swells, the eggs are placed under her, she dies, and the crust of her body forms their winter protection. But in some varieties two generations appear in one year. The apple-tree louse hatches from the end of May to the middle of June: they are whitish; in ten days they fasten themselves, and begin to throw out bluish down; and there appears two broods in the year.

They are destroyed by birds of the *wren* genus, ichneumon flies, and by washing the bark early in June. See *Bark Cleaning*. When they infest the roots, applications must be made to those parts.

BARK MILL. See *Mill.*

BARK, SPENT, from the tanners, forms a good manure when rotted with farm-yard manure, or made into a compost with lime, &c. It is also used for hot-beds.

BARK STOVE. A glazed house for tropical plants, heated by bark beds.

BARLEY. *Hordeum distichum.* It is readily distinguished from other grain by its pointed extremities, and by the rough appearance of its outer skin.

Botanists place barley in the family of the *Gramineæ*, and Linnæus has classed it in the second order of his third class (*Triandria digynia*), having three stamina and two styles in the flower.

Of all the cultivated grains, barley is perhaps that which comes to perfection in the greatest variety of climates, and is, consequently, found over the greatest extent of the habi-

Fig. 1.

a. Winter barley.
b. The same, with part of the seed pulled off the rachis.
c. A side view of the last, to show the shape of the rachis.
d. The three perfect grains adhering together by the base, as pulled off the rachis

table world. It bears the heat and drought of tropical regions, and ripens in the short summers of those which verge on the frigid zone. In genial climates two crops of barley may be reaped in the same year: one in spring, from seed sown the preceding autumn, and one in autumn from a spring sowing.

Agricultural writers in general have distinguished the different species of barley, either from the time of sowing them, into winter barley and spring barley, or, from the number of rows of grains in the ears, into six-rowed, four-rowed, and two-rowed or flat barley. Another distinction may be made between those which have the corolla strongly adhering to the seed and those in which it separates from it, leaving the seed naked, from which circumstance these are called *naked* barleys. There seem, in fact, to be only two very distinct species of barley generally cultivated: one which produces three perfect flowers, and as many seeds united at the base, at each joint of the *rachis*, or middle of the ear, alternately on each side (*Fig.* 1); and another, in which the middle flowret is perfect and the two others barren, forming a flat ear, with only one row of grains on each side, as spring barley (*Fig.* 2). The first species has sometimes the middle flowret small or abortive, and consequently only four rows of grains, giving the ear a square appearance; but that this is only an occasional deviation is proved by its returning to the perfect ear with six rows, in rich soils and under proper cultivation.

In some varieties of both kinds the seeds stand more apart from each other, and at a greater angle with the rachis; the ear is also shorter, giving it the appearance of a bat or fan, whence it has been called Battledore barley; it is also known by the name of Sprat barley. In others the corolla separates from the seed when ripe, and the awns fall off: these are the naked barleys. Each of these has been in repute at different times.

Winter barley is mostly sown in those countries where the winters are mild and the springs dry, as in the south of France, Italy, and Spain, or in those where the snow lies deep all the winter, and where the sun is powerful immediately after the melting of the snow in spring. In climates where the winter consists of alternate frost and thaws, and the early part of spring is usually wet, the young barley is too apt to suffer from these vicissitudes, and the spring-sown barley gives the more certain prospect of a good crop; but

Fig. 2.

a. An ear of common spring barley.
b. The same, with the grain partly pulled off.
d. The single grain, with the remnant of the two abortive flowers.

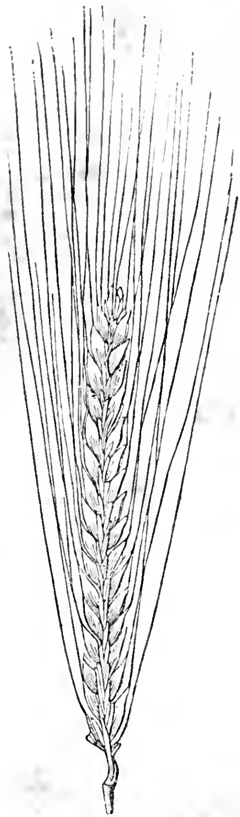
the grain of the latter is seldom so heavy as that which has stood the winter.

The *Siberian barley*, a variety of which, with naked seeds, has been highly extolled by foreign agricultural writers, especially by Thaer, under the name of *Hordeum cœleste*, seems to be a superior sort in rich soils, not only for its heavy and nutritious grain, in which particulars it is said to approach to the quality of rye, but also for its succulent stems and leaves, which make it by far the best sort to sow for the purpose of green food for cattle and sheep; and if fed off early the roots will, in a rich soil, shoot out an abundance of fresh stems, and produce a good crop of grain at harvest.

The barley most commonly cultivated is that which has only two rows. It is almost universally sown in spring.

Particular varieties have been in great repute at different times, when first introduced, and then seem to have degenerated and lost their superiority. Of this kind is the *Moldavian* barley. This barley was much sought after some years ago; and lately the *Chevalier* barley (*Fig.* 3), so called from the gentleman who first brought it into notice. It is said that, having observed an ear of barley in his field greatly superior to the rest, he carefully saved the seed, and cultivated it in his garden till he had a sufficient quantity to sow it in a field. It has since been extremely multiplied and diffused through the country. Some eminent maltsters and brewers have declared that it contains more saccharine matter than any other sort; and the trials hitherto made have convinced many agriculturists that it is not only heavier in the grain, but also more productive. In 1832, Mr. Coke, of Norfolk, who was always foremost in all agricultural experiments and improvements, sowed a considerable portion of land with this barley, and the result is said to have been perfectly satisfactory. In the year 1833 the writer of this article sowed two acres of Chevalier barley in the same field

Fig. 3.



[Chevalier Barley.]

with some of the best of the common barley. The soil was poor, light sand, but in good order, and very clean. The produce of the whole was nearly the same, four quarters per acre; but the Chevalier barley weighed 57 lbs. per bushel, while the common weighed only 52. This gives the farmer an advantage of nearly ten per cent. The sample was very fine, and the whole that he could spare was eagerly purchased by his neighbours, for seed, at his own price. It is long in the ear and very plump, and the plants tiller* so much, that half a bushel may be saved per acre in the seed. This is probably owing to its grains being all perfect, and vegetating rapidly. The straw, like that of the other long-eared barleys, appears weak in proportion to the ear; it is said also to be harder, and not so palatable to cattle. These are circumstances which experience alone can ascertain. That hitherto it has had a decided superiority over the common sorts, no one who has tried it fairly in well-prepared land seems to deny; but unless great care be taken in cultivating picked parcels for seed, selecting the finest ears and plumpest grain, it will probably share the fate of its predecessors — degenerate, and lose its reputation. Might not the cultivation of the various kinds of grain purposely for seed be more generally practised, and form a distinct branch of agriculture? Thus the good qualities of any grain might be perpetuated, new varieties might be produced, and the defects corrected by cultivation, as is the case with horticultural plants.

The sprat or battledore barley (*Fig.* 4), also called Putney barley, from having been once extensively cultivated near that place, is in much esteem in Germany. It is the *Hordeum Zeocriton;* also called *German rice*, or *rice barley*, not from any resemblance it bears to rice, but because, when deprived of its skin and made into pot barley, it swells by boiling, and makes a good substitute for rice in broths and puddings.

All kinds of barley require nearly the same soil, and, whether they are sown before winter or in spring, the ground must be well prepared, and the soil pulverized by repeated ploughings and harrowings, or by the operation of those instruments which have been invented for this especial purpose, in order that the fibres of the roots, which are very minute and delicate, may penetrate the soil easily in search of nourishment.

* A plant is said to *tiller* when it produces several stems from the crown of the root at the surface of the soil.

Fig. 4.

[Sprat (or Battledore) Barley.]

The soil can scarcely be too dry on the surface at the time of sowing; and, provided a few showers supply the moisture necessary to make the seed vegetate and spring up, there is no great danger to be apprehended from too dry weather. Barley has been known to grow and ripen when not a single shower refreshed the soil from the day it was sown to that in which it was reaped.

The quantity of barley sown formerly was four bushels per acre; but if the land is duly prepared and the seed good, from two to three bushels are an ample allowance, especially if sown by the drilling machine.

The proper time for sowing barley depends much on the season and the state of the land. The best practical rule is, to sow as soon in March as the ground is dry. The early-sown crops are in general the heaviest, especially the sorts which ripen later: they require less seed, having more time to tiller before the hot weather draws up the stems. There are, however, seasons when the later-sown crops are the best. A good rule is to sow a quick-growing sort when the sowing is unavoidably deferred, and in this case more seed must also be allowed.

The depth at which the seed should be deposited depends on the nature of the soil and on the season. Winter barley need only be slightly covered, and will tiller astonishingly in good light soils. But in stiff soils the seed, buried deep, may have much difficulty in germinating, the air not having sufficient access, and the first shoot not being able to pierce the compact soil above it. As a general rule, a depth of one inch and a half is most likely to enable the seed to sprout well, and give a sufficient hold of the land by the roots to avoid the danger of lodging. After sowing barley it is useful to pass a light roller over the land, across the beds, if there are any, to press the earth on the seed, and prevent too great evaporation of the moisture. When the plants begin to tiller, another rolling, and in some cases a slight harrowing, to loosen the surface and thin out the plants where they grow too close, are very useful. This also is the best time to sow clover and grass seeds, if not done with the first rolling. After this no attention is required to the crop till harvest, unless some docks or thistles should make their appearance, which must then be carefully pulled up.

The practice of sowing clover, rye grass, or other seeds with the barley, is almost universal, and is considered as one of the great modern improvements in agriculture. There is no doubt a great advantage in having a profitable and improving crop to succeed the barley without farther tillage; and clover prepares the land admirably for wheat. Still there are some doubts whether this be profitable in all cases. There are seasons when the clover materially injures the barley by its luxuriance; and in wet seasons at harvest it is very difficult to dry the straw sufficiently, mixed as it is with the succulent stems of the clover, or to prevent its heating in the stack. The clover, as far as the barley is concerned, may be looked upon as a weed, which, like all other weeds, must take a part of the nourishment from the crop, and check its tillering. If the clover is sown late among the barley, the danger is less. It will not be able to grow so high as to do much injury, but the fear of losing the plant of clover makes most farmers prefer sowing it soon after the barley.

In Flanders, clover is seldom or never sown with barley, but chiefly with rye; but they sow a species of white carrot instead in the sandy soils. These push out very little of the green top, but shoot their fibres downward, which form the rudiments of the carrot. After harvest, the ground is well harrowed, and watered with liquid manure. The carrots, which could scarcely be observed above ground, soon spring up, and a good crop is secured before winter, extremely useful for feeding cattle and swine, and greatly increasing the urine of cows and bullocks, the favourite manure for light soils in that country.

As soon as the ears of the barley begin to droop and lose their purple hue, acquiring a light straw colour, before the grain is quite hard, it should be reaped. This is usnally done by mowing it with a scythe, having a *cradle* fixed to it so as to lay the swathe regularly; but where there is a sufficient supply of labourers, at reasonable wages, it is far more profitable to have it reaped with the sickle, or, what is better, with the *Hainault scythe*, a short, broad scythe, used with one hand, while a light hook is held in the other to lay the straw even, so as to be readily tied up into sheaves. A little practice enables a man to reap twice as much corn in the same time with this instrument as with the reaping hook. Binding into sheaves is a great advantage; much less corn is shed, which, in the common method of raking into heaps, often amounts to more than would fully sow the same extent of land. The sheaves set up on end are in less danger from the weather, and when the stack is built all the ears may be laid inward and much grain saved, which, if on the outside, would soon be the prey of birds: smaller stacks may be made, and the danger of heating entirely avoided. The stacks should be built on frames, supported by stone or cast-iron pillars, with flat caps on them to keep out vermin; and, in large stacks, it is useful to have a kind of open cage in the middle, to allow the admission of air to the centre. This dries the grain better than a kiln, and when the stack is properly thatched with straw, the crop may be considered as safe till it is carried into the barn to be thrashed.

Barley requires care in thrashing, to break off all the awns close to the grain. A thrashing machine does not accomplish this perfectly by only once passing the straw through the rollers; it is consequently usually put through a second time, especially if it has not been tied into sheaves. It is often necessary, after the barley is thrashed, to effect this by another operation, which is called *hummeling*, for which purpose several different kinds of instruments are used. A simple one consists of a cylinder composed of small bars of iron, and placed on an axis, which is rolled backward and forward over the grain; or, where a thrashing machine is used, a plate of iron, perforated like a nutmeg grater, is fixed to the inside of the drum in which the beaters revolve, and the awns are effectually broken off by this rough surface

The diseases to which barley is subject while growing are those which attack all other grain—the smut, the burned ear, blight, and mildew; but it is less liable to these than wheat. The greatest enemy is a wet harvest. It is so apt to germinate with the least continuance of moisture, that, even before it is reaped, it often exhibits an ear in full vegetation, every grain having sprouted (see *figure*) It is then of little value, and even when this is checked by dry weather or in the kiln, the grain is so impaired as to be fit only to feed fowls and pigs. A strong plant of clover, by keeping the wet longer about the bar-

[Premature germination of an ear of barley.]

ley, often contributes to increase this evil, as has been hinted before.

The principal use of barley in this country is to convert it into malt for brewing and distilling. The best and heaviest grain is chosen for this purpose, and, as it must have its germinating power unimpaired, the least discoloration, from rain or heating in the stack, renders it suspected, and consequently not so saleable. It is, however, still fit for being ground into meal for feeding cattle and pigs.

The produce of barley, on land well prepared, is from 30 to 50 bushels and more per acre, weighing from 45 to 55 lbs. per bushel. It is said to contain 65 per cent. of nutritive matter; wheat contains 78 per cent. A bushel of barley weighing 50 lbs. therefore contains about 32 lbs. of nutriment, while a bushel of wheat weighing 60 lbs. contains 47 lbs. Good oats weighing 40 lbs. contain about 24 lbs. of nutritive substance, so that the comparative value of wheat, barley, and oats, in feeding cattle, may be represented by 47, 32, and 24, the measure being the same. The experiments on which this calculation is founded were carefully made by Einhof, and confirmed, on a large scale, by Thaer, at his establishment at Mögelin, the account of the results being accurately kept.

On all good loamy soils barley is a more profitable crop than oats, and is supposed to exhaust the soil less. On stiff, cold clays it does not thrive so well, and there oats are to be preferred. In some districts, where the best barley is grown, the farmers seldom sow oats, and many prefer buying them for their own use, with the additional expense of market and carriage.

Barley in its green state makes excellent spring food for milch cows; it comes in early, and greatly increases the milk. It is also very good for horses, provided it be given sparingly at first, as it purges them; but after a little time, when the stomach becomes accustomed to it, it increases their flesh and condition wonderfully, and is much more wholesome than the usual spring physic, as it answers the purpose of gently clearing the intestines without any risk of irritation. For sheep it is more nourishing than rye, and comes earlier; when fed off quite close in April, it will spring up again, and, on good land, produce a fair crop of grain.

M. Theodore de Saussure has carefully analyzed the ashes produced by burning barley and its straw, and we shall close this article with the result of his experiments.—(*Recherches Chimiques sur la Végetation*, Paris, 1804.)

The grain reduced to ashes *with its skin* gave, out of 100 parts, 18 of ashes, which contained:

Potass	18
Phosphate of potass .	9·2
Sulphate of potass . .	1·5
Muriate of potass . .	0·25
Earthy phosphates . .	32·5
Earthy carbonates . .	0
Silica	35·5
Metallic oxides . . .	0·25
Loss	2·8
	100

1000 parts of the straw produced 42 of ashes, containing:

Potass	16
Sulphate of potass . .	3·5
Muriate of potass . .	0·5
Earthy phosphates . .	7·75
Earthy carbonates . .	12·5
Silica	57
Metallic oxides . . .	0·5
Loss	2·25
	100

These products no doubt vary in different soils; but the proportion of silica in the straw and in the skin of barley is remarkable. This barley grew in a chalky soil.—(*W. L. Rham.*)

BARLEY, POT. Barley of which the outer husk or skin has been removed.

BARLEY, PEARL. The small round kernel which remains after the skin and a considerable portion of the barley have been ground off.

BARLEY GRASSES. Grasses of the genus *Hordeum.* They are coarse, and of little moment in agriculture.

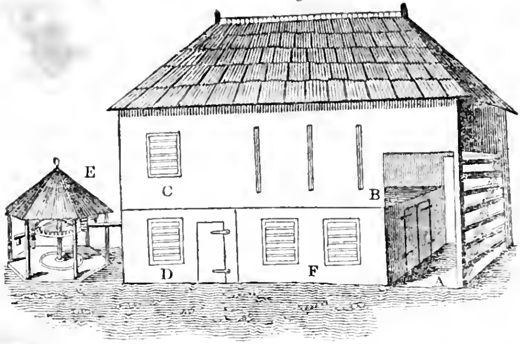
BARM. Leaven, yeast.

BARN. A building in which produce is stored to protect it from the weather and keep it in safety. In all countries where the climate does not permit the corn to be thrashed in the field and immediately put into a granary, it is necessary to protect it from the weather; and the most obvious method is, to have capacious buildings for that purpose. Accordingly, all well-appointed farms have one or more of these buildings, which formerly were made of such dimensions as to be capable of containing the whole produce of the farm, whether hay, corn, or straw. A great saving has been effected by the mode of stacking hay and corn in the open air, protected only by a slight covering of thatch. In consequence of this improved practice, modern barns are made of smaller dimensions, and their principal use is to contain the wheat in the straw which is intended to be thrashed out immediately; so that if the barn is capable of containing a thrashing floor and as much wheat in the sheaf as is usually put in a single stack, it answers all the purposes of a larger barn; and thus the expense of the farm buildings is greatly diminished.

The principal use of a barn being to thrash the corn in, its construction must be adapted to the mode in which that operation is performed. As many smaller seeds, such as clover and the grasses, cannot so well be thrashed by a machine, a floor, upon which they may be thrashed with the flail, is an indispensable appendage to a farm; and the barn is the most convenient place to have it in. This floor is commonly placed in the middle, with its length equal to the width of the barn. It also allows the wagons or carts, when loaded with the produce of the harvest, or of the corn taken from a stack, to be drawn over it and unloaded immediately in the barn. For this purpose, large double gates are placed at each end of the floor, of such dimensions as to allow a loaded wagon to be drawn in on one side, and, when unloaded, taken out at the other. When the width of the barn is not sufficient for the length of the floor, a porch is added on one side, or both, and in these the gates are placed. Those parts of the barn which are on one side of the thrashing floor are called the bays, and in these the corn is placed till it is thrashed. Where there are porches, the roof of the barn is generally brought down to the line of the porch; and thus convenient sheds are formed on each side. One of the defects of this construction is, that the drawing of loaded wagons on the floor materially injures it, even where the precaution is taken of spreading straw over it. In consequence of this, many barns have been constructed without the large gates, and the corn is thrown from the wagon outside, through an opening called a *pitch hole*, into the barn. This has the inconvenience of loss of time, and the risk of damaging the corn in showery weather. The best plan, therefore, is to have a passage for the wagons under the roof, at the end of the barn, where they can with ease and safety be unloaded; and if a thrashing machine is used, a floor raised about seven feet above the ground will contain the machine at one end, and the unthrashed corn at the other: the lower part may be appropriated to various useful purposes; that part which is immediately under the machine receives the corn and straw after they are separated, and contains the winnowing machine. (See *Fig.* 1.)

A, the place for unloading the corn; B, a floor seven feet from the ground, on which the wheat in the straw is stored; C, the place of the thrashing-machine at the end of the floor; D, a chamber under the floor, into which the thrashed corn and the straw fall, and the corn is winnowed; E, the shed for the horses to work under; F, a place under the floor, in which agricultural implements are kept: it may be converted into a stable. Double gates at each end of A will shut the whole up; or the end B may be closed by a partition with double doors in it. The windows are latticed.

Fig. 1.



In this case the seeds may be thrashed on the raised floor, which must be made strong and well jointed, to prevent the dust beating through, and steadied by pillars or a partition below. In small farms, where there is no thrashing machine, this construction is not so advantageous, the raised floor being unnecessary; still, it would be better not to draw the wagons on the floor. The thrashing floor may be placed at one end of the barn, the wagons unloaded at the other, and the corn deposited between them.

A common thrashing floor is usually from eighteen to twenty feet long, and from twelve to fourteen wide; the size must depend on the number of men who thrash at the same time, this operation being more rapidly performed by three or four men, beating in regular time, than if they worked separately.

Thrashing floors are usually made of stone, brick, oak, or tempered earth. The first are the most durable, and where stone can be obtained at a reasonable price, they are, in the end, the cheapest; but they are apt to bruise the corn, and on that account are not so generally adopted. Brick floors have the same inconvenience, besides that of readily imbibing moisture, and making the grain feel cold and damp, which diminishes the value of the sample. Earthen floors, when carefully laid, and the materials well incorporated, are both cheap and durable, provided the soil on which they are laid is dry naturally or made so artificially. But earthen floors have always the inconvenience of wearing into dust of a gritty nature, which, mixing with the corn, deteriorates it, and renders it less fit to be ground into fine flour. Hence, in spite of the first cost and frequent repairs, wood floors are preferred. Some nicety is required in laying floors, that they may not be subject to rapid decay, owing to the confinement of moist air below them. The planks should be two inches and a half thick, the edges well joined by *dowelling*, or *ploughing and tongueing*. *Dowells* are pins of half an inch diameter and six inches long, driven three inches deep into holes of the same diameter in the edge of the planks, and received into corresponding holes in the adjoining planks, so as to keep them close together and their surfaces even. Ploughing and tongueing is done by means of a groove in each edge, into which a slip of lath is driven, half in each groove. This produces the same effect of joining the planks close, besides completely preventing any dust from passing between the joints. The planks are driven close by means of wedges, and are laid on sleepers, to which they are fastened by a few iron spikes driven into each, and which rest on a foundation of brickwork, so that the floor is eight or ten inches from the ground. This interval has been sometimes filled up with stones or gravel, under the idea of preventing the nestling of rats ; but this is not a good practice. A free current of air under the floor is the only method of securing it from damp, and consequent dry rot. This should be provided by means of openings through the walls or under the sills. Iron gratings will keep out the rats ; but even should they find their way under the floor, they must be hunted out and destroyed by dogs.

The outer walls of barns are built of stone or brick, or consist only of wood.

The roof of a barn should be constructed according to the approved rules of carpentry, so as to produce the greatest strength with the smallest quantity of timber. This is a point seldom attended to by country carpenters, who imitate the old roofs, in which strong beams, resting on the walls horizontally, generally bear the whole weight of the roof without regard to the advantage gained by proper trussing. Even in the most temporary shed the strength may be greatly increased by using the materials judiciously. It is usually shingled. The common covering in England is thatched straw, which has the great inconvenience of affording shelter for rats, who soon nestle in it, and are not easily driven out.

The more the air circulates the better the corn is preserved. Barns should, therefore, have numerous openings, and the wheat, when put into them, should not be pressed down close to the walls, as recommended in many agricultural works, but so placed as to allow the air to circulate freely. In this manner it will keep well, without acquiring the close and musty smell which so much deteriorates that long kept in a barn. Hay is now seldom put into a close barn, experience having shown that it keeps much better in the open air in ricks. But where a considerable quantity of hay is tied up in trusses for the market, it is extremely useful to have a building with a roof to protect them from the wet, and to load the carts under shelter. For this purpose, a kind of barn is contrived, which some call a *Dutch barn*, but which may very properly be called a *skeleton barn*, being the frame of a barn without the boarding. The annexed figure will convey a better idea of it than any description. At the time of haymaking, this barn is extremely useful to draw a load of hay in suddenly on the appearance of a shower ; and hay put into either side will be preserved as well as in a stack. But for this purpose another building is in use in Holland, to which the name of Dutch barn is more appropriate, and of which we also annex a figure. This consists of a roof supported by strong poles, like masts, A A, on which it can be raised or lowered at will. The usual form is that of a pentagon ; the poles are at the angles, and kept upright by means of a strong still on a brick foundation,

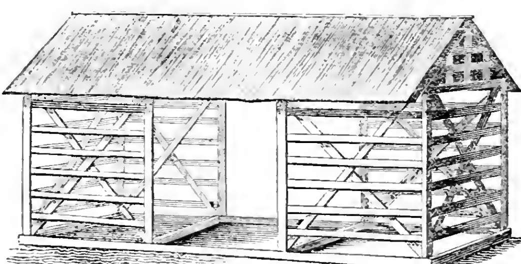


Fig. 2.

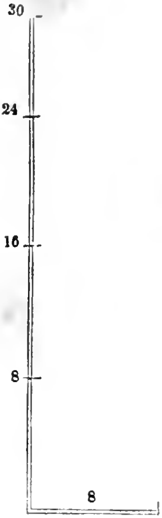


Fig. 3.

and pieces, B, acting as spurs, framed into the poles. The roof is light and covered with thatch. At each angle is a strong block of wood, with a round hole in it, sufficient to let the poles pass through ; these blocks are kept at any desired height by means of iron pins passed through holes made in the poles, and on which the blocks rest. To raise the roof, a small jack is used, an instrument well known by its use in raising heavy wagons when the wheels are taken off. This is placed on an iron pin at some distance below the roof, and the corners are raised gradually, one after the other, at opposite angles, the pins being moved each time one hole higher. The chief use of this Dutch barn is to contain hay, which may be placed in safety, in any small quantity, as soon as made, the roof being raised as the quantity increases, and gradually lowered as it is taken off for the cattle, which is always from the top. In small dairy farms in Holland, this building is found so useful that few are without one. Four posts are quite enough.

BARN OWL. This bird is a valuable destroyer of rats, mice, and small vermin.

BAROMETER. Of all the meteorological instruments the barometer is the most useful to the cultivator. Although its principal object is to indicate the pressure of a column of air, the variations of this same pressure are so intimately connected with divers other atmospheric phenomena, that one can almost daily recur to its indications with profit.

The barometer in its simplest form is a tube curved into a siphon (*Fig.* 1), closed at the upper end, with a pear-shaped enlargement at the lower end, completely void of air, and partly filled with mercury. When the tube is placed in a perpendicular position, the metal, after some oscillations, settles itself at a height which represents the weight of the atmosphere, and which varies more or less, according as that weight augments or diminishes

Fig. 1.

Fig. 2.

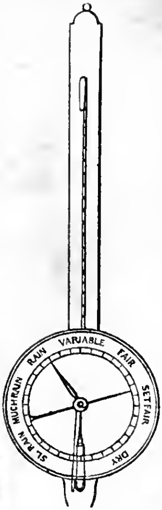


Fig. 3.

By an ingenious mechanism, Torricelli adapted to the siphon barometer a dial (*Fig.* 2), upon which a needle indicates the movements of the mercury. This instrument, which is quite common, can nevertheless be consulted with advantage.

The barometer (*Fig.* 3) presents this difference from the preceding, that the tube, instead of being recurved, plunges perpendicularly into a basin partly filled with mercury. It is fixed to a scale, graduated on one side in inches and tenths.

The mercury in the barometer is seldom to be seen so low as 28 inches, or higher than 30½. It indicates as follows:

31 inches . .	Very dry weather, hard frost.
30½	Settled fair, settled frost.
30	Fair, frost.
29½	Changeable.
29	Rain, snow.
28½	Much rain, much snow.
28	Stormy weather.

The straight barometer is better than the weather-glass. In mountains the mercury never reaches 30½ inches, but remains always at a distance below, proportionate to the height of the place above the level of the sea. In foretelling changes of weather, the act of falling or rising in the mercury is better than an inspection of its height. The following rules by Mr. Walker are as good as any extant:

1. The barometer rising, may be considered as a general indication that the weather, comparatively with the state of it at the time of observation, is becoming clearer.

2. The atmosphere apparently becoming clearer, and the barometer above *rain*, and rising, show a disposition in the air for fair weather.

3. The atmosphere becoming clear, and the barometer above *changeable*, and rising, indicate fair weather.

4. The atmosphere clear, and the barometer near *fair*, and rising, denote continued fair weather.

5. Our prognostic of the weather is to be guided relatively, thus: if, notwithstanding the sinking of the barometer, little or no rain follow, and it afterward rise, we may expect continued dry weather.

6. If, during a series of cloudy, rainy weather, the barometer rise gradually, though yet below rain, especially if the wind change from the south or west towards the north or east points, clear and dry weather may be expected.

7. The weather for a short period, viz., from morning until evening, may commonly be foretold with a considerable degree of certainty. If the barometer has risen during the night, and is still rising, the clouds are high and apparently dispersing, and the wind calm, especially if it be in or about the north or east points, a dry day may be confidently expected. The same rule applies for predicting the weather from evening till morning.

8. The barometer should be observed occasionally thrice in the day, or oftener when the weather is changeable, in order to notice whether the mercury be stationary, rising, or sinking; for, from this circumstance, together with the direction of the wind and the apparent state of

the air at the time, is information to be collected, and a continuance of the same, or a sudden change of the weather, to be foreseen.

Lastly, observe always, the higher the mercury shall stand in the scale in each instance, and the more regularly progressive its motion shall be, the stronger will be the indication; likewise, the more the wind inclines towards the north or east points, the greater will be the disposition in the air for fair weather. The indications of rainy weather will obviously be the direct reverse of those rules which predict fair weather. Frost is indicated in winter by the same rules that indicate fair weather; the wind being in or about the north or east points, and the thermometer sinking towards 30. A fall of snow seldom comes without a previous frost of some duration, and is indicated by the sinking of the barometer, especially if the mercury be below *changeable*, and the thermometer at or near the freezing point. When the temperature of the air is about 35, snow and rain sometimes fall together; at a warmer temperature than 35 it seldom snows, or rains at a colder temperature. Thunder is presaged by the same rules which indicate rain, accompanied by sultry heat, the thermometer being up to 75. Storms, hurricanes, and high winds, are indicated by the barometer falling suddenly, or sinking considerably below *much rain*. The barometer is known to be rising or sinking by the mercury having either a convex or concave surface, or by the perceptible rise or descent of the mercury, if at the time of observation the barometer be gently rapped. If at any time the weather should differ widely from the indications of the barometer, it may be presumed, as it is sometimes known to happen, that a particular spot is affected by local circumstances. After a long-continued series of wet weather, we may, when the weather becomes fine, expect an uninterrupted continuance of dry weather. If, after a long series of wet weather, the barometer rise above *changeable*, and the wind veer steady to the north or east points, a continued duration of fair weather may be expected. Slow and progressive variations in the barometer, with a fixed and steady state of the wind, indicate permanency with the change. The barometer standing at or above *fair*, denotes generally fair weather, although the atmosphere wear at the time an unfavourable aspect.

The greater coincidence there is of the circumstances enumerated in the rules above mentioned, the stronger may our confidence be in the expectation of fair weather; and in the continuance of it when present, by the barometer, while high, remaining stationary, or varying but little, and the state of the atmosphere and direction of the wind disposed to be settled. In this variable climate there is no reliance to be placed on any rules beyond those above mentioned, for indicating the weather for any length of time together, or for any distant period. Combined with a careful examination of the direction of the wind, and the amount of vapour in the air, barometrical observations become a valuable means of forming an opinion on the state of the weather a few hours in advance.

BARRAS. The resin which flows from the bark of fir-trees.

BARREL. An English beer measure of thirty-four gallons. In the Southern States, a measure of corn equal in the ear to ten bushels, or five bushels shelled. A barrel of flour contains 196 pounds.

BARREN FLOWERS. Those which contain stamens only; they are easily known by the absence of the swelling under the (*ovarium*) flower. By high cultivation flowers become barren, and contain no stamens: when these bear fruit, it is without seeds; hence the well-known seedless varieties of orange, grape, &c.

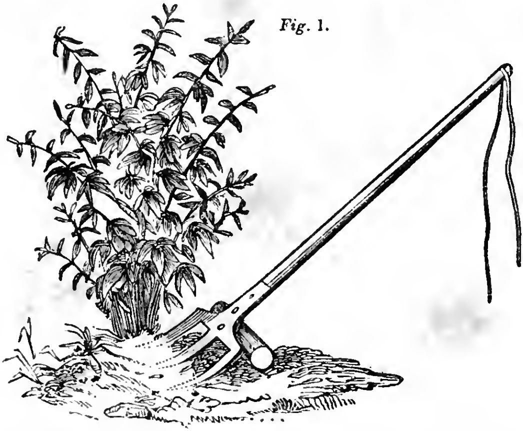
BARREN LAND. In agriculture, land in which the plants generally cultivated do not prosper or arrive at maturity. This barrenness may arise from various causes. The texture of the soil may be such that the moisture essential to vegetation cannot be retained, or that the fibres of the roots cannot penetrate in search of food. The first is the case in loose silicious sands, the second in rocks and indurated clays. It is seldom that either of these soils can be rendered productive, so as to repay the expense of cultivation, unless under particular circumstances. The most barren sands will become productive by irrigation, and in that case the labour applied to improve their texture, by the admixture of more tenacious earth, may be occasionally repaid. The vine may be made to grow in the fissures of the hardest rocks, where the climate is favourable; and terraces may be formed, by which the soil brought on may be retained; but, in general, loose sands and rocks ought to be left to their natural state of barrenness.

We shall endeavour to give, as briefly as possible, an outline of the various means by which even the poorest soils may be rendered capable of adding something to the general stock of food. The question as to the policy of cultivating such lands is not here considered. Our object is to show how barren lands may be improved whenever such improvement may be deemed expedient.

Some lands are barren in consequence of noxious ingredients in the soil, which, by their chemical action on the food of plants, or on their minute fibres, prevent their growth and render them sickly and abortive. These, having been ascertained by careful analysis, must be deprived of their noxious qualities by chemical means, one of the most obvious of which is liming. Nature has supplied a general and complete antidote to acid combinations, in lime, one of the most abundant mineral productions. There are few bad soils which lime will not improve. The most common substances found in barren soils are different combinations of metals, principally iron, with sulphur and acids; quicklime either decomposes all these or renders them innocuous. Another substance is *tannin*, or the astringent principle, which is of vegetable origin, and, by preventing the solubility of vegetable fibres, transforms them into an inflammable substance well known by the name of peat or moss. This, likewise, is readily corrected by the same means. But the different substances of which a soil is composed may be perfectly innocuous to vegetation, and yet the barrenness may not be the less, if the supply or circulation of moisture be deficient or excessive. This must, therefore, be the first consideration, before any improvement is attempted; and if sufficient moisture cannot be supplied, or superfluous removed, all other attempts will only be lost labour. In tropical climates, irrigation is the chief source of fertility; and the most expensive works have been constructed, both in ancient and modern times, to supply the land with water as occasion requires. In northern and moister climates, the foundation of all improvements in the soil is a proper outlet to superfluous water. These two subjects will be treated in the articles *Irrigation* and *Draining*.

Supposing, then, that the moisture has been regulated, and that the land is to be brought into cultivation, the first thing to be done is to remove obstructions and impediments, whether they be rocks, stones, trees, or shrubs, or only the heath and coarse grasses which generally cover waste lands. Rocks may be quarried or blown, and so may stones too large to be removed whole, and the fragments will often be useful in building the necessary farm offices, or making fences to divide the land into fields of convenient dimensions, and especially to keep off animals from destroying the crops. A simple method of getting rid of large stones is to dig a deep hole by the side of them, as near as possible, and roll them in, so that they may be buried at least two feet below the surface. If the nature of the stones is lamellated, and they will split, wedges of iron driven into holes made in the direction of the layers readily divide them into flat pieces extremely convenient for use. A very powerful wedge for this purpose is an iron cylinder cut through the axis into two pieces, between which a thin iron or steel wedge is inserted; a hole is bored in the stone of a diameter equal to that of the cylinder, and when this cylinder and wedge are put into it, the wedge is driven in with repeated smart strokes of a hammer. Several such wedges, placed in a line, will split large masses of the hardest granite, and, next to gunpowder, are the most efficacious instruments for that purpose. Trees must be grubbed up by the roots; and it saves labour to cut the roots below the ground while the tree is standing, and draw the tree over by means of ropes fixed to the top; the stem becomes a lever, by which the roots are more easily drawn out. Useless shrubs are readily cut down, and serve for fuel; their roots are seldom difficult to grub up; a simple and powerful instrument for this purpose is a very strong iron three-pronged fork, having the prongs twenty inches long, and a strong ashen handle, twenty feet long, fixed firmly into it,

Fig. 1.



to the end of which a rope is fastened; this is driven obliquely under the roots, and, by means of a log as a fulcrum, it forms a lever when pulled down by the ropes.

There are two methods by which the heath and grass of the surface may be got rid of: by mowing them close to the ground and ploughing in the roots, or by paring the surface and burning it. Each mode has had its strenuous advocates, and has been alternately praised and reprobated. A little consideration will soon settle this point. If the soil consists of clay or loam containing the yellow ore of iron, and if the ashes, after the sods have been burned in heaps, are of a bright red colour, the effect of burning the surface will be generally advantageous, even where the soil is already deficient in vegetable matter; for the fire will do more good in correcting the crude qualities of the soil than the small quantity of vegetable matter which is dispersed would have done had it been decomposed in the most favourable manner; and the tough roots which are reduced to ashes would have taken a very long time to decay, and would have been a constant impediment to the plough. But if the soil is a sharp sand, and the ashes are white and loose, burning destroys the small portion of vegetable matter in the soil, without compensating the loss by any advantage, and in this case burning the surface is inexpedient. The grass must be ploughed in, and not too deep at first, that it may soon rot; a coating of lime ploughed in will accelerate the decay of the grass. This kind of soil requires the addition of vegetable and animal matter to supply the humus in which it is deficient, and the principal attention must be directed to this object.

When the surface is very uneven, so as to form hillocks and hollows, in which water is apt to stagnate, levelling is a necessary process. If the soil is loose and sandy, it may be very expeditiously levelled by an instrument in use in Flanders, which they call a *mollebart*. It is a large

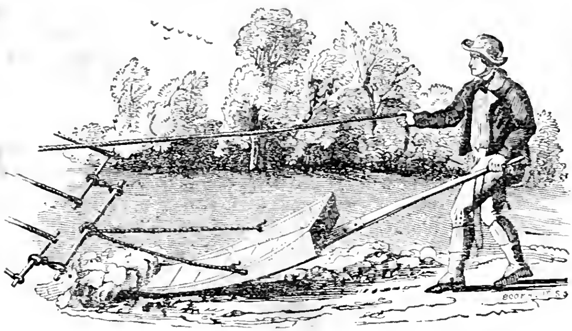


Fig. 2.

wooden shovel, shod with iron, having a long handle: about the middle of this shovel, which is convex at the bottom, are two hooks, one on each side, to which chains are fixed, which unite at the bar to which the traces of a horse or horses are to be attached: a rope fixed to the end of the handle completes the instrument. A man accustomed to the use of it raises the handle, and the shovel enters the ground, and is filled by the horse going on. By depressing the handle, the load is made to slide on the rounded bottom of the shovel till it arrives at the place where it is to be deposited. By letting the handle go, retaining the rope, the whole is upset instantly, turning over on the edge; the handle strikes on the bar, and the load is left behind in a heap. By pulling the rope the whole instrument resumes its original position, and is brought back to the place from which the earth is to be taken again, without any loss of time or the slightest stoppage of the horses. About five cwts. of loose earth may be thus moved at each time. By means of this machine the small fields in Flanders are raised about two feet or more in the centre, and the ground laid convex, sloping in every direction to let the water run off.

The land being now enclosed, fenced, and drained where requisite, obstacles to the plough removed, and in a tolerably level state, it remains only to consider how it may be most advantageously cultivated, so as in the end to repay the first and great outlay. Some lands which have lain waste for ages for want of a proper spirit of enterprise are found to consist of a tolerable depth of moderately fertile earth. These must be treated like a garden newly formed, and trenched as deep as possible; mere exposure to the air and frost will often make them highly productive, and in this case the only caution necessary is not to exhaust them at first. It is too common an error with those who have made a great outlay to be impatient, and expect too rapid a replacement of the capital laid out.

This makes them sow grain crops in preference to roots and legumes; and as fresh earth is generally very productive, especially in straw, they imagine the land to be of a better quality than it really is, and soon exhaust it, by which they lose infinitely more in the end than if they began with roots and green crops, and raised a quantity of manure by the stock fed on them. Lime excites new land wonderfully, and no manure is more active, provided there be vegetable matter in the soil, or added at the same time. Bone-dust will raise a better crop of turnips than lime alone, and is chiefly of use in raising the first crop of turnips. It should therefore be used sparingly, unless obtained cheap, and only on light loams or sands. Mixed with ashes in a heap, and allowed to heat, it becomes much more efficacious.

Nothing has so rapid an effect in removing sterility as the free use of the urine of cattle, and the draining of dunghills, collected and allowed to ferment in covered tanks; but this can only be obtained by keeping cattle stalled and fed with provender brought to them. This is the great secret of the fertility of the once poor barren heaths of Flanders. In different situations it may not be practicable to procure sufficient manure, at least at first, and the progress will be much slower. In this case the seeds of rye, tares, beans, buckwheat, and other succulent plants must be sown, and the crop ploughed in when in blossom: potatoes and other roots may be raised, to be consumed by cattle and swine, in sheds built for the purpose near at hand, and every means that ingenuity can devise must be resorted to in order to make as much manure as possible. This is not to be applied to the land at once, but mixed up in heaps with parings of the surface, with the ashes of roots burned, and with lime, and when thoroughly incorporated by frequent turning, mixing, and repeated watering with liquid manure, a good coat should be put on the land at once, as far as it will go; for one acre brought into a tolerably fertile state will repay the cost better than many imperfectly improved; and by proceeding gradually in this way, more land will be brought into a state fit for cultivation at the end of a few years, and at less expense, than could have been done by beginning with too much at first.

What has been said of poor land, or sandy loam, is applicable to every kind of unproductive soil, difference of composition and texture being kept in view. Poor, wet, stiff lands must be divided by deep ditches, ploughed in high ridges, and be as much as possible exposed to the wind and frost: grasses must be sown such as suit the soil. Paring and burning the surface are here generally useful in the first instance, and may sometimes be repeated with advantage. Such soils, in the end, are best calculated for permanent meadows; but it is essential to get them into a sound and fertile state by tillage and manuring, and by clearing them of all the roots and seeds of weeds before they be laid down with grass seeds, which must therefore be done with a first crop after a clean fallow, or, which is still better, without any crop of corn at all, and kept free from coarser grasses by hand-weeding. *Inoculating* grass is by far the readiest way of producing a permanent sward. See *Grass Land.*

There is another kind of barren soil, which extends over large tracts, well known by the name of peat, or moor. This, being chiefly composed of vegetable matter, is too loose in its texture for any vigorous vegetation; but, besides, it is of an insoluble, astringent nature, highly unfit for the increase and nourishment of plants. Moors being generally situated in valleys between mountains, draining off the superfluous water is the first and indispensable operation before any improvement of them can be thought of. The next thing is to compress the soft soil into a more solid state, and for this purpose any kind of earth or gravel is useful by its mere mechanical pressure. The surface may be burned in sods, and the ashes will greatly improve the remainder. Lime, marl, and shells are the specific correctors of the quality and texture. By the help of these, the soft mass is gradually condensed, and a more compact soil formed. The great object is to prevent the absorption of too much moisture by the still unconsolidated mass, which is effected by cutting numerous and deep ditches in every direction, with proper outlets kept carefully open, at the same time guarding against the opposite extreme of drying this spongy substance too much. If it is dry at top, and moist, but not boggy, a foot below the surface, it will be in the best state to improve and consolidate. It is surprising how soon a peat moss, of little more solidity than a bog, can be rendered perfectly firm, and bear even loaded wagons on its surface. It often happens, where there is a command of good water which can be brought above the level of the old peat moss, that it may be converted into a most productive water meadow. All that is required is, that the upper soil, artificially produced, be not broken through, and that the bottom be well drained. The great value of the peat and muck as a manure is a stimulus to the ditching.

We have only given brief hints and outlines to those who may be inclined to render lands productive which have hitherto been barren. The certain cost and probable improvement must be well calculated and compared to avoid disappointment and loss. As these depend on the peculiar circumstances of each case, it is impossible to give any general idea of them; but, by beginning on a small and experimental scale at first, and proceeding cautiously, new modes of lessening the expense of many of the operations will be suggested, errors will be avoided, and some certain practical ground of calculation will be obtained.—(*W. L. Rham.*)

BARROW. In agriculture, a mound of earth, sometimes called pies, or camps, under which potatoes or other roots are stored for protection from frost. They are usually made by excavating the ground, which should be high and dry, about one foot and a half deep, from four to five wide, and of a length proportionate to the number of bushels to be stored. The earth dug out is thrown evenly on both sides the hole. Before storing, a layer of straw is put down by some farmers; but this is unnecessary: the potatoes, &c., are next piled up in a rounded form, with the greatest height, of three or four feet, in the middle of the mound; straw is laid over them, and the dry earth of the excavation piled on from two to two and a half feet, and flattened with the spade. Round the barrow a ditch is dug, deeper than the floor within, to drain off water. Whatever is stored should be sound, and previously well aired. Where the crop is large a number of barrows are made. They should be placed in a northeastern exposure, for it is not frost that is injurious to vegetables so much as sudden thaws, produced by the direct rays of the sun. In taking out potatoes, &c., for the market or use, if they be found frozen, thaw in spring water before selling.

(*In machines.*) Barrows are light carriages to be moved by the hand. When furnished with a wheel they are termed wheelbarrows, and are of many forms.

BARS. In farriery, those portions of the crust or hoof of horses that are reflected inward, and form the arches situated between the heels and the frog.

Bars of a Horse's Mouth.—The fleshy rows that run across the upper part of the mouth, and reach almost to the palate. They form that part of the mouth on which the bit should rest, and have its effect.

BAR-SHOE. A particular kind of shoe, which is sometimes of necessity used to protect a tender frog from injury, the hinder part of the shoe being thickened and hollowed over the frog; but unless it is made exceedingly heavy it will soon be flattened down, and in the mean time it will most injuriously press upon the heels.

BARYTA. The oxide of barium,

an alkaline earth closely resembling lime, but not very abundant. Many of its salts are isomorphous with those of lime.

BASALT. A rock of great hardness and volcanic origin, containing iron, lime, and sand. It does not differ from trap except in colour, and occasionally in putting on the columnar form. The Palisades of the Hudson are a range 40 miles long of this rock.

BASE. In chemistry, a term used to designate those substances which readily combine with acids, as alkalies, metallic oxides, &c. In general terms, all substances which readily combine with others.

BASE. In architecture, a pedestal.

BASIL. A fragrant, aromatic, herbaceous plant, the *Ocymum basilicum*, a native of India, whose leaves are much used in cookery for the purpose of giving a savoury flavour to dishes.

BASKET. A vessel made of interwoven twigs of willow, osier, birch, splits of white oak, or of straw, grass, or rushes.

BASS. The inner bark of the lime or linden tree (*Tilia glabra*), used by gardeners to bind plants, and, in the form of mats, to protect trees, frames, &c.

BASSORIN. A peculiar gum, resembling gum *tragacanth*; insoluble, but swelling in water. It is sometimes called CERASIN.

BATH. In chemistry, sand, water, or oil heated in a metallic vessel for the purpose of communicating a steady and regulated heat to chemical vessels in distillation, drying, or evaporation.

BATRACHIANS, BATRACHIA. (Gr. *βάτραχος, a frog.*) An order of ***Reptilia***, including the frogs and toads, and all reptiles which, like them, have naked skins and external branchiæ in the early stage of existence; those batrachia which retain the gills or gill-apertures throughout life are called "perennibranchiate," or "amphibious."

BATTATAS. A name for the sweet potato.

BATTENS. Slips of wood two to four inches broad.

BAULK. A piece of whole timber squared. In *ploughing*, strips of unploughed land between furrows.

BAUME'S AREOMETER, or HYDROMETER. A hydrometer, the 0 of which is pure water at 58° Fahr., and the 15° the density of a mixture of 15 parts common salt and 85 parts water, by weight. See *Hydrometer*.

BAY. The term for a colour inclining to chestnut. In reference to a horse, this colour has various shades, from the very light bay to the dark bay, which approaches nearly to the brown; but it is always more gay and shining. There are also coloured horses that are called dappled bays. Bay horses have black manes, which distinguish them from the sorrel, that have red or white manes. There are light bays and gilded bays, which are somewhat of a yellowish colour. The chestnut bay is that which comes nearest to the colour of the chestnut.

BAY. A common name for the laurels, especially *Laurus nobilis*. *Bay-berry* is the *Myrica cerifera*.

BAY OF A BARN. The place where the mow is stored.

BAY SALT. Salt made by evaporating sea water in the sun. The best is from Turk's Island. It is preferred for putting up pork and provisions.

BEAGLE. The old hare-hound, now becoming superseded by the harrier.

BEAK. Rostrum, the prolonged or sharp termination of a fruit.

BEAM. A stout, horizontal timber used to resist or sustain weight.

BEAM OF A PLOUGH. The upper shaft to which the irons are fastened. It should be of good ash or oak.

BEAM-TREE. *Pyrus aria*. A small tree with tough wood.

BEANS. Plants belonging to the natural family *Leguminosæ*. Two genera are commonly included under this name, *Vicia* and *Phaseolus*, of which several species and numerous varieties are cultivated. The genus *Phaseolus* produces generally runners, or pole beans, but this depends much on soil, for the *Ph. nanus* is a bush bean. The *Vicia faba* is the parent of many varieties known under the general title of English dwarfs.

English dwarfs: varieties:

Early Mazagan.	Green Nonpareil.
Broad Windsor.	Horse.
Sword Long Pod.	Heligoland.

Of these, all but the last two are cultivated in the garden, and the horse and Heligoland in the field. They are sown as soon as the frost is out of the ground, for the late plants are destroyed by heat before they bear well.

All the varieties thrive best on strong clay soils, heavy marls, and deep loams of a moist description. In such soils the produce is sometimes 30 to 60 bushels per acre, but an average crop on moderate land is about half that quantity. On very rich land beans have produced extraordinary crops by being sown broadcast and very thick, the stems being brought up to a great height in favourable seasons. A small field of very rich land, in the county of Sussex, England, was sown in the year 1832 with four bushels of the small tick bean, which came up so thick that the proprietor thought of thinning out the plants by hoeing, but he was advised to see what the produce would be, and when they were thrashed out there were eighty-one bushels of beans. He had the ground accurately measured, and it was found to be one acre and twenty-nine perches, which makes the crop above sixty-eight bushels per acre.

Beans are propagated by seed, which may be sown broadcast, drilled, or dibbled; if sown broadcast, three or four bushels of seed per acre will be required, which should be ploughed or harrowed in; if drilled, two or two and a half per acre will be sufficient. Beans are tolerably hardy, and will bear moderate dry frosts, but they suffer much from alternate frosts and thaws.

The following, from the late Judge Buel's agricultural tracts, gives all the necessary information on the culture and produce of this valuable crop:

"*Field Culture of Beans.* — Beans may be cultivated in drills or in hills. They are a valuable crop, and with good care are as profitable as a wheat crop. They leave the soil in good tilth. The China bean, with a red eye, is to be preferred. They ripen early, and are very productive. I cultivated beans the last year in three different ways, viz., in hills, in drills, and sowed broadcast. I need not describe the first, which is a well-known process. I had an acre in drills, which was the best crop I ever saw. My management was this: On the acre of light ground, where the clover had been frozen out the preceding winter, I spread eight loads of long manure, and immediately ploughed and harrowed the ground. Drills or furrows were then made with a light plough, at the distance of two and a half feet, and the beans thrown along the furrows about the 25th of May, by the hand, at the rate of at least a bushel on the acre. I then gauged a double mould-board plough, which was passed once between the rows, and was followed by a light, one-horse roller, which flattened the ridges. The crop was twice cleaned of weeds by the hoe, but not earthed. The product was more than forty-eight bushels by actual measurement."

A sprinkling of three or four bushels of gypsum is advantageous.

The beans are collected with a plain scythe or sickle before they are fully ripe, but turned yellow. In this way loss by scattering seed is avoided. The whole is cured by exposure in swarth and cock, and made into light stacks, until the time serves for thrashing. The beans are obtained either with the flail, treading out, or passing through the thrashing machine, set sufficiently coarse for the purpose. If the straw, or haulm, be well cured, it answers as good coarse food for cattle and pigs during the winter.

Beans are also raised in Germany for soiling, and cut during the summer season when in pod. They are an exceedingly acceptable food, and may, by proper management in sowing several lots at different times, be kept in cutting order for three months. The Heligoland, horse, and English tick bean are the favourites for field culture.

Value of Beans.—This crop is not so extensively cultivated as it deserves. In common with other leguminous crops, it is of advantage in opening the soil by its long roots, in absorbing much of its food from the atmosphere, and leaving the soil in admirable tilth, preparatory to a grain or tobacco crop; but these good points are insignificant in comparison with the great value of beans and pease as food for horses, sheep, and, indeed, all animals.

The proportion of nutritive matter in beans, compared with other grain, is, according to Einhof,

	By weight.	Or in a Bushel.
Wheat . .	74 per cent.	about 47 lbs.
Rye . .	70 "	" 39
Barley . .	65 "	" 33
Oats . .	58 "	" 23
Beans . .	68 "	" 45
Pease . .	75 "	" 49
Kidney beans .	84 "	" 54

Not only is there so great a proportion of nutritive matter, but that present is remarkably rich in the azotized or flesh-making ingredients, often as much as twenty to thirty per cent. of casein being present in seeds grown on a rich soil. Von Thaer, as the result of his comparative estimate, obtained by feeding cattle, gives to field beans a value equal to one third of rich wheat and two thirds of Indian corn or barley. In feeding, it is best to crush or grind the beans and pease.

Kidney beans, or French beans (*Phaseolus vulgaris*). Of the dwarf kidney, the varieties are

Early China.	Red Cranberry.
Early Cluster.	Warrington, or Marrow.
Early Dun-coloured.	Refugee, or Thousand to One—good for pickling or laying down in salt.
Early Half Moon.	
Early Mohawk.	
Early Rachel.	
Early St. Valentine.	Rob Roy.
Early Yellow Six Weeks.	Large White Kidney, or Royal Dwarf.

The pole, or runners, are varieties of the *Ph. limensis* and *multiflorus*. They are

Saba, or Carolina.	Red Cranberry.
Dutch Case Knife.	White Cranberry.
Large White Lima.	White Dutch Runners.
Speckled Prolific Lima.	
Asparagus, or Yard Long.	Scarlet Runners.
	London Horticultural.

A choice new variety, under the name of turtle-soup bean, has been recently cultivated with great success.

Nearly all of these are confined to the garden except the refugee and China, the cultivation of which last is similar to that already detailed for beans. I therefore only introduce such observations as belong to garden culture.

The soil for them may be anything rather than wet or tenacious; for in such the greater part of the seed decays without germinating, while those plants which are produced are contracted in their produce. A very light mellow loam, even inclining to a sand, is the best for the earliest sowings, and one scarcely less silicious, though moister, is preferable for the late summer crops; but, for the later ones, a recurrence must be made to a soil as dry as for the early insertions. For the early and late crops, a sheltered border must always be allotted, or in a single row about a foot from a south fence, otherwise the situation cannot be too open.

Dwarfs.—The sowing commences with the year. They may be sown towards the end of January, in pots, and placed upon the flues of the hothouse, or in rows in the mould of a hot-bed, for production in March; to be repeated once every three weeks, in similar situations, during February and March, for supplying the table during April, May, and June. At the end of March and April a small sowing may be performed, if fine open weather, under a frame without heat, for removal into a sheltered border early in May. During May, and thence until the first week in August, sowings may be made once every three weeks. In September, forcing recommences: at first, merely under frames without bottom heat, but in October, and thence to the close of the year, in hot-beds, &c., as in January. Sowings, when a removal is intended, should always be performed in pots, the plants being less retarded, as the roots are less injured, than when the seed is inserted in patches or rows in the earth of the bed. It is a good practice, likewise, to repeat each sowing, in the frames without heat, after the lapse of a week, as the first will often fail, when a second, although after so short a lapse of time, will perfectly succeed. In every instance, the seed is buried one and a half or two inches deep. The rows of the main crops, if of the smaller varieties, may be one and a half; if of the larger, two feet apart, the seed being inserted, either in drills or by the dibble, four inches apart; the plants, however, to be thinned to twice that distance.

If any considerable vacancy occurs, it may always be filled by plants carefully removed by the trowel from where they stood too thick. A general remark, however, may be made, that the transplanted beans are never so productive or continue so long in bearing (although sometimes they are earlier) as those left where raised. The rows of the earlier crops are best ranged north and south. The seed inserted during the hottest period of summer should be either soaked in water for five or six hours, laid in damp mould for a day or two, or the drills be well watered previous to sowing. The only after-cultivation required is the destruction of weeds, and earth to be drawn up round the stems.

The pods of both species are always to be gathered while young; by thus doing, and care being had not to injure the stems in detaching them, the plants are rendered as prolific and long-lived as possible.

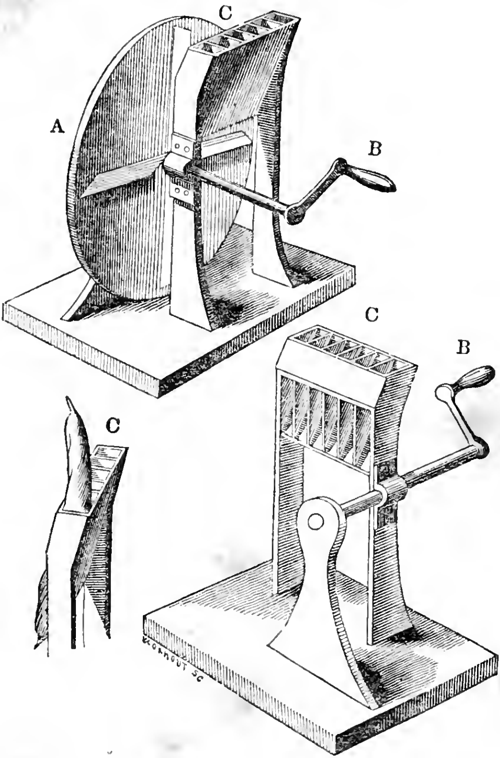
Runners.—As these are more tender, and the seed is more apt to decay than those of the dwarfs, no open ground crop must be inserted before the close of April, or early in May, to be continued at intervals of four weeks through June and July, which will ensure a supply from the middle of this last month until October. Some gardeners force them in a similar manner to the dwarfs; they certainly require similar treatment; but they will endure a higher temperature by a few degrees. They are so prolific, and such permanent bearers, that three open-ground sowings of a size proportionate to the consumption will, in almost every instance, be sufficient.

The runners are inserted in drills, either singly, three feet apart, or in pairs, ten or twelve inches asunder, and each pair four feet distant from its neighbour. The seed is buried two inches deep and four inches apart in the rows, the plants being thinned to twice that distance. If grown in single rows, a row of poles must be set on the south side of each, being fixed firmly in the ground; they may be kept together by having a light pole tied horizontally along their tops, or a post fixed at each end of a row, united by a cross-bar at their tops; a string may be passed from this to each of the plants. If the rows are in pairs, a row of poles must be placed on each side, so fixed in the ground that their summits cross, and are tied together. They are sometimes sown in a single row down the sides of borders, or on each side of a walk, having the support of a trellis-work, or made to climb poles which are turned archwise over it.

As the plants advance to five or six inches in height, they should have the earth drawn about their stems. Weeds must be constantly cleared away as they appear. When they throw up their voluble stems, those that straggle away should be brought back to the poles, and twisted round them in a direction contrary to that of the sun: nothing will induce them to entwine in the contrary direction, or from left to right.

For the production of seed, forty or fifty plants of the dwarf species will be sufficient for a moderate-sized family, or thirty of the runner. They must be raised purposely in May, or a like number from the crop in that month may be left ungathered from; for the first pods always produce the finest seed, and ripen more perfectly. In autumn, as soon as the plants decay, they must be pulled, and, when thoroughly dried, the seed beaten out and stored.—(*G. W. Johnson's Kitchen Garden.*)

The bean, as an esculent vegetable, is wholesome and nutritious in a fresh state, and may be readily preserved for winter store or sea voyages by salting in casks. For this purpose, the large, flat-podded, Dutch white runner is preferred. In Holland and Germany, where large quantities are salted in almost every family, a machine is used for cutting them expeditiously, which greatly resembles a turnip-slicer, and may, with a slight alteration, be used also for slicing cabbages when making the national German preparation of sour krout (*sauer kraut*). It consists of a wheel or disk (see *figure*), A, in which two or four knives are set at a small



angle with the plane of it, so as to shave off a thin slice obliquely from the beans, which are held in a box, C, with several partitions, in which they are kept upright, so as to slide down in proportion as they are cut: thus six or eight beans are sliced at once, and very rapidly, merely by turning the handle, B, and supplying the box with beans in succession. A much more economical means would be to throw the beans into a hopper holding two or three pecks. The sliced beans fall on the table below, and are immediately put in a cask with alternate layers of salt. When the cask is full and well pressed down, a board and heavy weight are placed on them. As the beans ferment, the liquid produced is poured off, fresh salt added to the surface, and a linen cloth pressed close to keep out air; afterward the top of the cask and its weight are returned, and the whole kept for use. They are washed in fresh water when used, and form a wholesome vegetable dish in winter.

BEANS, DISEASES OF. The diseases are the rust, or mildew, which is a minute fungus that grows on the stems of leaves, attributed to cold fogs and frequent sudden transitions of weather, and the black dolphin or fly, also called the *collier*, an aphis of a bluish colour: it is devoured by lady-birds (*Coccinella septempunctata*, and other species). For the mildew no remedy has yet been found. Whenever it has attacked the plants, generally before the pods are filled, the best method is to cut down the crop in its green state; and if it cannot be consumed in the farm-yard, to plough it into the ground, where it will decay rapidly, and be an excellent manure for the succeeding crop of wheat. If allowed to stand, the crop will not only be unproductive, but the weeds will infest the ground, and spoil the wheat crop by their seeds and roots, which will remain in the soil. Whenever the tops of the beans begin to be moist and clammy to the feel, it is the forerunner of the aphis. They should then be immediately cut off, and this, if done in time, may save the crop from the ravages of the insects; but the most effectual way to prevent any disease from attacking the plants in their growth is to have the ground in good heart, and well tilled; to drill the beans at a sufficient distance between the rows to allow the use of the horse-hoe, and thus to accelerate the growth of the plants, and enable them to outgrow the effect of incipient disease, which seldom attacks any but weak plants.

BEANS, SOUTHERN. Several varieties are cultivated in Virginia, Georgia, and Southern States, under the name of pease, as cow pea, cornfield pea, Indian pea, &c. They are hardy, grow on stiff lands, and ameliorate their condition; planted with corn, they twine about the stem without hinderance to it. On rich soils they run too much to leaf; but in poorish clay may be cultivated as a field-crop without support, if in a well-drained situation. The yield is large, and the bean agreeable to horses and all animals. The green plant is occasionally turned in as a fallow crop.

BEAR BERRY. The *Arctostaphylus (arbutus) uva ursi*. A small evergreen shrub of northern America and Canada, used as an astringent and tonic.

BEARD. The awn of barley, &c.

BEARER. In building, any upright which supports timbers.

BEAR'S FOOT. The hellebore.

BEASTS. In farming, neat cattle.

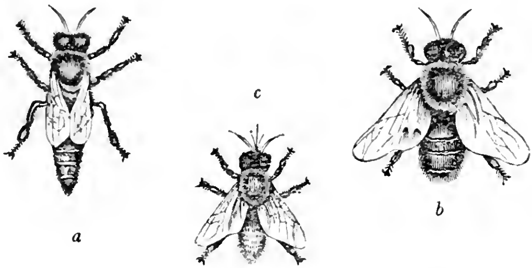
BEDS. In geology, seams of strata, as coal beds.

BED STRAW. The *Galium verum*, yellow goose-grass, a perennial weed, the juice of which is acid, and sometimes used to curdle milk in the place of rennet.

BEECH. *Fagus sylvatica*, var. *Americana*, white beech, and *F. ferruginea*, red beech, are handsome American trees, especially the latter, which is the larger, and more like the European tree. The wood is firm, but liable to insects; the bark yields sufficient tan for leather; but the mast, or nut, is the most valuable, from the excellent oil it contains, which is expressed in Europe for table use. Hogs fatten more rapidly upon beech mast than any other common food; the fat is, however, oily. The beech prefers rich alluvial soils, and yields a large amount of potash in its ashes. The timber cut in the sap is said to be the most durable.

BEER. The fermented infusion of malt, flavoured with hops. But other sweet infusions, treated in the same way, or without hops, are also termed beers, as persimmon beer, sassafras, liquorice, and sarsaparilla root beer.

BEES. *Apis mellifica.* A familiar insect, much admired for its instinct and industry. *Natural History.* — There are three orders of bees in each hive; the queen (*a*), drone (*b*), and labouring bee (*c*); there is but one queen, distinguished by a longer



a *c* *b*

body and greater size than all the other inhabitants; she is the only female in the hive, and is, therefore, watched with great interest by the others, who attend her in her duties, and live only in peace while assured of her presence. The drones are the males: they are larger and nearer spherical than the labourers, and without stings. After their duty is performed in autumn, the drones are expelled from the hive by the labourers, and killed or driven abroad to die. There are from 300 to 1000 drones in the hive. The labourers form the rest of the inhabitants, and vary in number from 5000 to 20,000. They are smaller than the rest, armed with a sting, and neuter in sex, or, more correctly, they are females in which the ovaries are undeveloped. The neuters divide themselves in companies to carry on the business of the hive; some collecting honey, others building the comb, and another body nursing the young. The bees which go abroad seek for three distinct kinds of matter, viz.: honey, farina or bee meat, and propolis. The first, which also contains more or less wax, is obtained from flowers, and in part converted into wax by the insect itself. The farina is stored up in cells as food for the young, and is of a whitish colour, altogether differing from honey; propolis is a resinous exudation gathered from different trees, as the black gum, wherewith the bee closes crevices in the hive and stops the cells of the young. As soon as flowers begin to expand, the labourers and queen bee are aroused from the lethargy of winter and recommence the labours of the hive. The queen lays about 50 eggs a day, for six or eight weeks: these are all neuters. Having finished this deposite, she then lays the eggs of drones, and lastly, those for queens. At this season she produces but one egg a day; the number of queen eggs varies from 3 to 20; they are deposited in large conical cells called royal cells. The working community in the mean time introduce food into each cell, taking care to furnish the future queens with regal fare, different from that of the neuters. In three days the eggs are hatched and produce a worm, which feeds upon the bee bread stored in its cell, and at the end of a few days spins itself a web and enters upon a series of transformations, ending, in 21 days from the deposite of the egg, in the production of a young bee; this eats its way through the propolis that closes its cell, and is nourished by the nursing bees until it is strong enough to enter on the labours of the hive. In due time the queen eggs are con-rted into bees. As soon as the old queen perceives evidence of this, she becomes uneasy, and communicates her apprehension to the neuters, many of which share in her anxiety: thus she collects many faithful followers, and leaves the hive, carrying off the *first swarm*, which is always led by the old queen. The first young queen now comes forth, and quickly discovers the cells of her sisters, which she attempts to destroy, but is hindered by the bees; whereon she runs to and fro among the hive and succeeds in carrying off another swarm. After this, the next queen usually succeeds in destroying her rivals, and remains in the old hive. The first swarm may be known by the presence of drones in June, sooner or later, according to the season. This is the swarming season, and measures are now to be taken to recover the bees and form new hives. The two swarms come out at intervals of a few days; occasionally there are more, but they are not sufficiently numerous to form a new hive, and should be returned. The bees come out in large numbers, and make their way to an adjoining bush or tree, where they accumulate in a dense cluster, usually on one branch. The loaded branch is now to be carefully cut without disturbance, and the whole swarm laid upon a white cloth, or a table, on the ground, and a hive inverted over the bees; if everything is favourable, the swarm enters the new hive, and may be removed in a few hours to the stands; but this is not always the case, for should there be more than one queen present, the swarm is kept in great turmoil, and battles ensue until the number is reduced to one; but in these conflicts it sometimes occurs that all the queens are killed, and the young swarm returns to the parent hive to wait for a new sovereign. The skilful apiarian, therefore, always takes care, before hiving a swarm, that the queen is present, and only one, removing every other and putting her to death instantly. In the swarming season, certain ancient practices prevail, of beating iron pans, shouting, blowing trumpets, and throwing sand into the air, intended as a means of frightening the bees and hindering them from flying too far from the hive ground; but it is unnecessary if sufficient shrubs be in the neighbourhood. The hive in which the new swarm is received should be provided with cross sticks in the upper part, to afford them a starting point for their architecture; it should be without chinks or crevices, for these have to be filled by the colony with propolis, and cause a waste of time; moreover, to give them a fair start, they should be fed with sirup for a few days. The labourers begin at the roof with their comb, arranging a number of different parallel structures in the direction marked out by the sticks introduced. The cells have an hexagonal section and are prismatic in form, so arranged as to admit of the introduction of honey until full, when they are sealed with wax: in the lower division of the hive, the cells for eggs are arranged; these are filled with the farina, or bee bread. About August, the bees of the preceding year die, the drones are expelled, and the hive is fully under the control of the new generation; honey is stored as long as flowers are abundant, and where buckwheat and clover abound this takes place into October. As soon, however, as flowers become scarce, the colony begins to consume its own sweets, and should be supplied with sirup. The position of the apiary should be sheltered from the great heat of the day, and rapid alternations of temperature; they love plenty of free air, but should not be liable to chilly winds. In the winter they should be removed to a dry cellar, lest, being tempted by an occasional gleam of sunshine, they leave the hive and suffer death. The temperature should be above the freezing point. As then they require less food to sustain life, it is advisable, also, to keep the hives covered with straw, &c., provided always there be a free draught of air, for an entire colony is frequently suffocated by stopping up the door of the hive. The hives should not be taken out until the weather is becoming settled and flowers are expanded.

The quality of the honey made depends upon the food supplied. Many plants are reputed to yield poisonous honey, as the dwarf and great laurel (*Kalmia angustifolia* and *latifolia*), the mountain laurel (*Rhododendron maximus*), the moor wort (*Andromeda mariana*), wild honeysuckle (*Azalea nudiflora*), Jamestown weed (*Datura stramonium*), &c.

Fruit-trees, the linden, tulip-tree; varieties of clover, especially white clover; aromatic herbs, as thyme, mint, and marjoram; turnip, mustard, and cabbage blossoms, are extremely grateful; buckwheat imparts a harsh taste. Water is also relished by these insects, so that they prefer a position near a limpid rill. It is also advised by some to place a vessel of water near their hive, into which floating sticks should be introduced to serve them as standing places to drink from.

The quantity of honey varies with the season and the size of the swarm. Thirty pounds is a good yield where the bees are not destroyed; of this, from a pound to a pound and a half will be wax.

The honey is removed with or without the destruction of the insects; the latter method is accomplished by suffocating the colony with the fumes of burning sulphur, but is rarely practised in the United States, and is, moreover, without economy.

Partial deprivation with the common barrel hive is performed about the beginning of September. Having ascertained the weight of the hive, and, consequently, the quantity of honey-comb which is to be extracted, begin the operation as soon as evening sets in, by inverting the full hive and placing an empty one over it; particular care must be taken that the two hives are of the same diameter, for if they differ in their dimensions it will not be possible to effect the driving of the bees. The hives being placed on each other, a sheet or large table-cloth must be tied round them at their junction, in order to prevent the bees from molesting the operator. The hives being thus arranged, beat the sides gently with a stick or the hand; but particular caution must be used to beat it on those parts to which the combs are attached, and which will be found parallel with the entrance of the hive. The ascent of the bees into the upper hive will be known by a loud humming noise; in a few minutes the whole community will have ascended, and the hive with the bees in it may be placed upon the pedestal from which the full hive was removed. The hive from which the bees have been driven must then be taken into the house, and the operation of cutting out the honey-comb commenced. Having extracted the requisite quantity of comb, this opportunity must be embraced of inspecting the hive, and of cleaning it of any noxious matter. In cutting the combs, however, particular attention should be paid not to cut into two or three combs at once, but, having commenced the cutting of one, to pursue it to the top of the hive; and this caution is necessary for two reasons: if you begin the cutting of two or three combs at one time, were you to abstract the whole of them, you would, perhaps, take too much; and, secondly, to stop in the middle of a comb would be attended with very pernicious consequences, as the honey would drop from the cells which have been cut in two, and then the bees, on being returned to their native hive, might be drowned in their own sweets. The bees, also, in their return to their natural domicil, being still under the impression of fear, would not give so much attention to the honey which flows from the divided cells; and, as it would fall on the board, and from that on the ground, the bees belonging to the other hives would immediately scent the wasted treasure, and a general attack on the deprivated hive might be the consequence. The deprivation of the honey-comb being effected, the hive may be returned to its former position, and, reversing the hive which contains the bees, and placing the deprivated hive over it, they may be left in that situation till morning, when the bees will be found to have taken possession of their native hive, and, if the season proves fine, may replenish what they have lost.

BEES, DISEASES OF. In the spring they are subject to a dysentery, known by the abundance of refuse, and an odour of putrefaction within the hive, which should smell like wax. It is said that a little brandy added to their sirup food cures this complaint. They are also attacked by a louse, which makes them irritable, but which may be removed from their bodies by brushing them with the feather of a pen.

BEE HIVE. The dwelling of the bees. The simplest form is a small barrel of four gallons, or the hollowed part of the trunk of a tree, or a thimble of rye straw holding about three pecks, and of a conical figure. Whatever the structure, it should be tight, solid, and dry, and so arranged as to admit of inspection. There is no subject on which so much ingenuity has been expended as the construction of beehives, the object being the separation of honey without disturbance to the labourers. The annexed is as good as any of these improved hives, as it has the following recommendations: 1st. It is capable of enlargement or contraction; 2d. May be opened without disturbance, for cleaning, taking honey, &c. It is known as the section hive, and consists of two, three, four, or more trays of similar size, fitting one above the other, as C C D (*Fig.* 1). These trays may be fourteen inches square and five deep (*Fig.* 2), the uppermost being provided with a cover to keep off rain. Through the bottom of each tray or box, slits, or holes about three fourths of an inch large, are perforated, the number being such that the bees may pass readily into an upper compartment to manufacture. The apertures, C C, represent doors for the bees, as well as windows through which to examine their work, and should be covered when not used. D is the entrance first used, until the

Fig. 1.

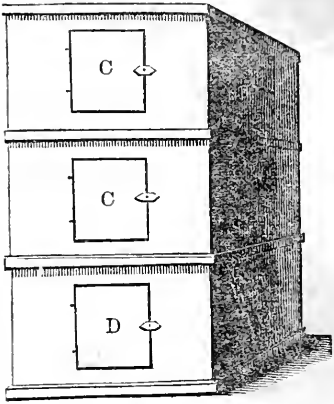
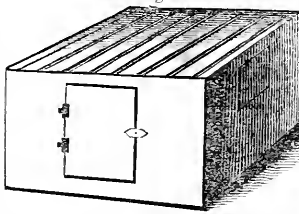


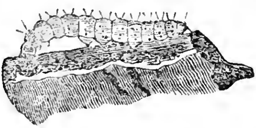
Fig. 2.



bees are settled in the upper divisions. The compartments are fastened together temporarily by buttons, and should be made tight by cement or coarse wax. To use this hive, the doors are all closed but the lowermost, into which the bees enter; they ascend from tray to tray, until they reach the uppermost, and here begin their work upon sticks properly placed; or, instead of making this division open, there are placed over the chinks jars, small boxes, or other receptacles, into which the honey is to be collected: the bees work in these As soon as they are engaged, an upper door can be opened for their accommodation, and the progress of the work can be watched through proper openings of glass, and by removing the top. As soon as these boxes are filled, they can be taken out by passing a sharp knife between the lowest edge and the bottom of the division. The bees are now occupied in the compartment below, and, should the season be propitious, may also fill that with honey. Under these circumstances, it will be advisable to lift up the hive, after closing the doors, and add another tray beneath. If this hive be sufficiently enlarged in spring, the young bees can be prevented from swarming, or the fresh swarm can be separated with the upper divisions, and carried to a new stand. The hive should be kept perfectly clean, and free from insects, and every crevice tight.

BEES, INSECTS THAT INJURE. They are troubled with a louse (*Braula cæca*) of the size of a flea, and resembling the Hippobosca. These produce great uneasiness. They may be removed by brushing a feather over the bees infested. The most important enemy is, however, the *Miller*, or *Honey-comb Moth* (*Galleria cereana*), the caterpillar of which, of a dirty white colour (*Fig.* 1) and brown head,

Fig. 1.



Caterpillar on a piece of honey-comb.

eats the honey-comb. The caterpillar grows to twelve lines' length, protects itself from the stings of the bees by a tubular web, and eats only at night. It is changed to a brown grub in ten to twenty-eight days, and the moth in fourteen more days, two generations occurring in the year. One moth appears in the spring, the other generation in July. The male (*Fig.* 2) is smaller than the female (*Fig.* 3); he

Fig. 2.

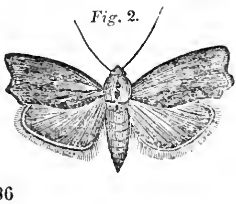
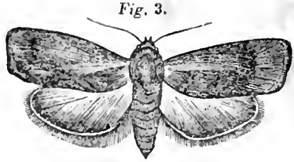


Fig. 3.



is of a clay yellow above, and yellowish brown on the abdomen; the colour of the upper wings ash-gray; the under wings lighter, and of a brownish tint. The female has a rusty brown back and head; the under wings almost white; she lays her eggs in the dirt, at the lower part of the hive, and in chinks, from whence the young crawl into the hive. The miller and its caterpillars are to be destroyed by repeatedly inspecting the hives in spring, and clearing them out. Hives are also constructed with inclined or wire gauze bottoms, from which all the feculent matters of the bees fall, so that the miller cannot lay her eggs; for she will not venture within the hive. Ants, spiders, and wasps are also very destructive to hives.

BEE-STING. The bee leaves its sting in the wound. It should be extracted, and the part rubbed with soap and a little dilute spirit of hartshorn (ammonia).

BEET. A plant of the genus *Beta*, in the natural order *Chenopodeæ* of Jussieu.

There are two distinct species of beet commonly cultivated, each containing several varieties; the one called *Beta cicla* or *hortensis*, producing succulent leaves only; the other, the *Beta vulgaris*, distinguished by its large root. The cicla is chiefly cultivated in gardens as a culinary vegetable, and forms one of the principal vegetables used by agricultural labourers and small occupiers of land in many parts of Germany, France, and Switzerland. A variety known by the name of Swiss *chard* produces numerous large, succulent leaves, which have a very solid rib running along the middle. The leafy part, being stripped off and boiled, is used as a substitute for greens and spinach, and the rib and stalk are dressed like asparagus; they have a pleasant, sweet taste, and are more wholesome than the cabbage tribe. In a good soil the produce is very abundant; and if cultivated on a large scale in the field, this species of beet would prove a valuable addition to the plants raised for cattle.

The second species, the *Beta vulgaris*, or beet-root, has been long cultivated in gardens, especially that variety called the red beet. It thrives best in a rich, light, dry soil, and, from the length of its tap-root, requires a considerable depth. The white beet is an excellent root, and is preferred by many to the larger and more common intermediate varieties. It has been lately in great repute in France and Belgium for the manufacture of sugar.

The common field beet for cattle has been long known in Germany. The German name is *mangold wurzel*, or *mangold* root, but it is commonly pronounced *mangel wurzel*.

The improved variety of this beet, which grows to a very large size in good soil, has a red skin, and, when cut through, appears veined with red in concentric circles. The principal part of the root rises often a foot and more above the ground, and the leaves, which are large and succulent, spring from the crown of the root. There is a limit, however, beyond which the root does not improve in quality as it increases, and the roots of a moderate size contain more saccharine and nutritive matter in the same bulk than the larger. This is particularly the case with those varieties from which sugar is extracted. The soil best adapted for the beet-root is a deep, sandy loam, naturally rich. The application of liquid manure during the growth of the plant greatly increases the roots; but it is also said to make them more watery, and for the sugar beet it is not recommended. It has been clearly demonstrated that azotized manures diminish the sugar of beets. The seed, which should be chosen from the most perfect plants, is sown in May, at four to five pounds the acre; it should be steeped three or more days in water before planting. It is found by experience that those plants of beet which grow from seed sown where they are to remain have larger roots, in general, than those which are transplanted; the seed is therefore usually drilled, or dibbled, in rows, from twenty-four to thirty inches distant; the seeds are put in about an inch deep, and when they are dibbled the holes are about four inches asunder, and two or three seeds are put in a hole. After they come up and are out of danger of frost or insects, they are thinned out so as to leave the plants a foot asunder. If the ground be well prepared there is little fear of the plants not coming up, or of their being destroyed by the fly, as is too often the case with turnips. A sprinkling of liquid manure along the rows, about the time that the plants first appear above ground, will, in general, secure an abundance of them; and this may be done with much less trouble than would be imagined by those who have never practised it. It requires only a water-cart, with a large cask and two leathern hose, kept at a proper distance from each other by a stick between them, so that they may pour the liquid manure over two rows at once. If the field be not above a mile from the tank, a man and horse will water two acres in a day; and if the distance is half a mile, four acres; the expense will be amply repaid in the crop.

On a very large scale this may not be so practicable; but wherever a field of beets is near the home-stall, it should never be omitted; the evident advantage of it will soon remove any objection arising from trouble or expense. When the plants are three inches above ground, and thinned, the intervals between the rows may be stirred with the plough, grubber, or horse-hoe, and the intervals from plant to plant in the row with the hand-hoe. The ground cannot be kept too fine and open, provided the soil be not extremely porous, and the weather very dry. It is a common practice to throw the earth from the rows against the roots; but the most experienced cultivators do not approve the method; on the contrary, they recommend drawing the earth from the plants, or at least laying the whole ground level. Where the soil is naturally rich and deep, the drills may be made on the level ground; but if the soil is shallow, or the subsoil of a barren nature, it is best to raise small ridges, as is done for turnips, and bury the dung under them, by which means the roots have more room to strike downward. As soon as the outer leaves begin to droop, they may be gathered and given to cattle, but a tuft should be left in the centre to carry on the vegetation, or else the roots will not increase. This practice of gathering the leaves is strongly recommended by some, and they assert that the root does not suffer in the least, although the leaves are reproduced; but here we would give this caution, founded on experience and observation. The drooping leaves, if not gathered, will decay and fall off; they have performed their office, and therefore to gather them before they wither is a real economy; but to strip off fresh and growing leaves must injure the plant, and the juices required to replace them are so much taken from the growth of the roots. When fodder is very scarce, this may be a sacrifice worth making; but if the object is to reserve the roots for winter food, the leaves should remain on the plant as long as they look fresh and growing, until near the time of taking up the whole crop; the top may then be cut off an inch above the crown of the root, and will be excellent food for the cows and pigs.

The roots are generally taken up and stored for winter some time before there is any danger of considerable frost, the top having been removed. The roots are then either stacked in a barn or root-house, with alternate layers of straw, and the sides and top protected from the frost by straw placed all round, in which way they will keep well and fresh till spring; or they are placed in trenches two feet deep and six feet wide, with a layer of straw at the bottom and against the sides: they are heaped up in these trenches to the height of three feet above the ground, forming a ridge at top, and then covered all over with straw, over which the earth taken out of the trench is spread and made smooth, sloping like the roof of a house. . A small trench is dug all round this heap, with a proper outlet to prevent any water from soaking in; the heaps are made of any length, according to the quantity of roots to be stored, and the two ends are secured with straw and covered with earth like the sides. When it is required to take out the roots for use, an opening is made at the end, a sufficient quantity is taken out, and the end is secured again with straw and earth as before. When the roots have been put in dry, and some time has been allowed for a slight fermentation, and the steam produced has been allowed to escape before the heap was finally covered in, they will come out quite fresh and juicy till late in spring; but if the proper precautions are neglected, they will often rot or become musty, and then the cattle will not readily eat them. There are few crops so valuable for winter food for cattle as the beet.

"*Expense of an Acre of Sugar Beets.*

Use of an acre of land well prepared for beets, and manured or managed in the previous crop	$12 00
Ploughing	4 00
Cultivating, horse cultivator and hand, 2 hours	50
Twice more before sowing . . .	1 00
Seed, $2 25; sowing with a machine, 75 cents	3 00
First hoeing	4 00
Second hoeing, thinning, and transplanting, to supply deficiencies . .	4 90
Hoeing again, and loosening the ground with machines	2 00
Harvesting	9 00
	$39 50

"Make the rows two feet four inches apart, and then a cultivator can be used in hoeing. If the beets stand one foot apart in the rows, and weigh two and a quarter pounds each, the yield will be twenty tons. In rich ground, at that distance, a great number will weigh four or five pounds each; twenty tons is a good crop, probably a large crop, but not extremely large, for in some cases twenty-five or thirty tons to the acre have been raised in this country. At the above expense of $39·50 to the acre, with a yield of twenty tons, the cost would be two dollars per ton. We make this estimate to show how cheap beets may be raised under favourable circumstances, such as good land at a fair price, convenient machinery and implements, and the most prudential management in the culture, with labour at a moderate price, and a favourable season."—(*Cultivator.*)

It is said that cows fed entirely on beets become too fat, and give less milk; but this would be no objection with the cow-keepers, who unite the fattening of their cows with the milking, and like to have them ready for the butcher as soon as they are nearly dry. For bullocks they are excellent; for horses, Swedish turnips are preferable. The proportional value of hay, potatoes, Swedish turnips, and beets, in feeding cattle, according to Einhof, whose statements Tnaer has found to agree with his experiments, is as follows: 18 tons of mangel wurzel are equal to 15 tons of ruta baga, or 7½ tons of potatoes, or 3¾ tons of good meadow hay, each quantity containing the same nourishment; but the roots may be grown upon less than an acre, whereas it will take two or three acres of good meadow land to produce the equivalent quantity of hay; and of all these root crops, the least exhausting for the land is the beet. The white beet has been chiefly cultivated for the extraction of sugar from its juice. It is smaller than the mangel wurzel, and more compact. We have given it to cattle, and are satisfied with the result; but we have not made sufficiently accurate experiments to decide which sort is the most advantageous. The crops vary from 600 to 1200 bushels. The beet, especially the white Sicilian, is better than mangel wurzel. They are improved by steaming, but must be fed up in two or three days, or they ferment. Seed plants are set out in May and gathered in September. It will probably be found that the nature of the soil will make the scale turn in favour of the one or the other; but for the manufacture of sugar, the smaller beet, of which the roots weigh only one or two pounds, are preferred by Chaptal, who, besides being a celebrated chemist, was also a practical agriculturist, and a manufacturer of sugar from beet root.

BEET SUGAR. This manufacture sprung up in France, it having been found that from the juice of the beet root a crystallizable sugar could be obtained. We here give a brief account of the process: The first operation is to clean the roots; some effect this by washing, but Chaptal prefers scraping and paring them with a knife, although by this means one sixth part of the root is wasted, as the scrapings mixed with earth cannot be safely given to cattle, and even the pigs eat but little of it; but it adds to the manure, and is therefore not altogether lost. Six tons of beet root are thus reduced to five, which are next to be rasped and reduced to a pulp. This is done by a machine consisting of a cylinder of tinned iron, two feet in diameter, and eighteen inches in the axis, on which it is turned by machinery. On the circumference of this cylinder are fixed, by means of screws, ninety narrow plates of iron, rising three fourths of an inch from the surface and parallel to the axis, at equal distances all round; the outer or projecting edges of these plates are cut into teeth like a saw; a slanting box is fixed to the frame on which the axis of the cylinder turns, so that the roots may be pressed against these plates. The cylinder is made to revolve rapidly, and the roots are thus scraped, the pulp falling into a vessel, lined with lead, placed below. When two such cylinders are made to revolve 400 times in a minute by a sufficient power, whether water, wind, or horses, two and a half tons of roots are ground down in two hours. It is necessary that this operation should proceed rapidly, or else the pulp acquires a dark colour, and an incipient fermentation takes place, which greatly injures the future results. As the pulp is ground it is put into strong canvass bags, and placed under a powerful press to squeeze out the juice. The residue is stirred, and subjected to a second and third pressure, if necessary, till every particle of juice is extracted. As the liquor is pressed out it runs into a copper until it is two thirds filled. The strength is ascertained by Baumé, which shows the specific gravity of the liquid. The fire is now lighted, and, by the time the copper is full, the heat should be raised to 178° of Fahrenheit's thermometer, but no higher.

In the mean time, a mixture of lime and water has been prepared by gradually pouring as much water upon 10 pounds of quicklime as will make the mixture of the consistency of cream. This is poured into the copper when the heat is steadily at 178°, and is well mixed with the juice by stirring it. The heat is then increased till the mixture boils, when a thick and glutinous scum rises to the surface. As soon as clear bubbles rise through this scum, the fire is suddenly put out by water poured on it, or by a proper damper. The scum hardens as it cools, and the sediment being deposited, the liquor becomes clear and of a light straw colour. The scum is then carefully taken off with a skimmer having holes in it, and is put into a vessel till such time as the liquor remaining in it can be pressed out. A cock is now opened about five inches above the bottom of the boiler, and all the clear liquor is drawn off. Another cock lower down lets out the remainder until it begins to appear cloudy: what still remains is afterward boiled again with what is extracted by pressure from the scum. The clear liquor is now subjected to evaporation in another boiler, which is wide and shallow. The bottom is but slightly covered with the juice at first, and it boils rapidly. As the water evaporates, fresh juice is let in. When a certain degree of inspissation or thickening has taken place, so as to show five or six degrees of strength on Baumé, animal charcoal is gradually added till the liquor arrives at 20°. One hundred weight of charcoal is required for the juice of two and a half tons of beet, which is now reduced to about 400 gallons. The evaporation by boiling continues till the saccharometer marks 25°, and a regular sirup is obtained. This is now strained through a linen bag, and the liquor is kept flowing by means of steam or hot air, and assisted by pressure. In two or three hours all the clear sirup will have run through.

The sirup thus prepared is again boiled and skimmed until it is sufficiently concentrated, which is known in the following manner: The skimmer is dipped into the sirup and drawn out; some of the thick sirup which adheres to it is taken between the thumb and forefinger, and held there till the heat is reduced to that of the skin; the finger and thumb are separated, and if the sirup is of a proper strength, a thread will be drawn out, which snaps, and has the transparency of horn, or, rather, barley sugar: this is called the *proof*. The fire is then put out and the sirup is carried to the cooler, which is a vessel capable of containing all the sirup produced by four operations or boilings. Here the sugar is to crystallize; as soon as this commences, the whole is well mixed and stirred, and, before it becomes too stiff, earthen moulds, of the well-known sugar-loaf shape, and of the size called *great bastards*, are filled with the crystallizing mass, of which a little at a time is poured into each. When they are full, they are carried to the coolest place on the premises. As the crystallization goes on, the crust formed on the top is repeatedly broken, and the whole is stirred till the crystals are collected in the centre: it is then allowed to go on without farther disturbance. In three days it is so far advanced, that the pegs which were put into the holes at the point of the moulds may be removed and the molasses allowed to run out. In a week this is mostly run off. White sirup is now poured on the top of the moulds, which filters through the mass and carries part of the colouring matter with it. The process that follows is exactly that in common use in refining West India sugars.

Although most of the operations are nearly the same as those by which the juice of the sugar cane is prepared for use, much greater skill and nicety are required in rendering the juice of the beet root crystallizable, on account of the smaller quantity of sugar that it contains. But when this sugar is refined, it is impossible for the most experienced judge to distinguish it from the other either by the taste or appearance. Five tons of clean roots produce about 4½ cwt. of coarse sugar, which give about 160 lbs. of double-refined sugar, and 60 lbs. of inferior lump sugar: the rest is molasses. The dry residue of the roots, after expressing the juice, consists chiefly of fibre and mucilage, and amounts to about one fourth of the weight of the clean roots used. It contains nearly all the nutritive part of the root, with the exception of 4½ per cent. of sugar, which has been extracted from the juice. Two pounds of this dry residue and half a pound of good hay are considered as sufficient food for a moderate-sized sheep for a day, and will keep it in good condition, and cattle in proportion.

By allowing the juice of the beet root to undergo the vinous fermentation, and by distilling it, a more profitable result will be obtained in a very good spirit. A kind of beer may also be made of it, which is said to be pleasant in warm weather and wholesome.

Another mode of making sugar from beet root, practised in some parts of Germany, is as follows, and is said to make better sugar than the other process. The roots, having been washed, are sliced lengthways, strung on packthread, and hung up to dry. The object of this is to let the watery juice evaporate, and the sweet juice, being concentrated, is taken up by macerating the dry slices in water. It is managed so that all the juice shall be extracted by a very small quantity of water, which saves much of the trouble of evaporation. Professor Lampadius obtained from 110 pounds of roots 4 pounds of well-grained white powder sugar, and the residuum afforded 7 pints of spirit. Achard says that about a ton of roots produced 100 pounds of raw sugar, which gave 55 pounds of refined sugar and 25 pounds of treacle. This result is not very different from that of Chaptal.

The manufacture of beet sugar in the United States cannot be made profitable, but may be useful in families, as the remaining mush is so valuable for cattle and pigs. They may be cultivated between 39 and 44 degrees north advantageously.

BEETLE. A common term used to designate the larger *Coleoptera*, with hard wing cases. See *Insects*.

BEETLE. A large mallet used to drive stakes, &c.; it is furnished with two or more handles, so as to be driven by several persons.

BELLADONNA. The deadly night shade, *Atropa belladonna*.

BELT. Trees arranged for shelter. Belting in the West is the practice of chopping away the bark of a tree around the stem to the extent of some inches. The wound should pass freely into the sap wood, otherwise the tree will not be killed.

BELVIDERE. A small place at the top of a house for a lookout.

BEN NUTS. The seeds of an Arabian plant called *Moringa aptera;* they yield an oil called oil of ben, and have been employed in syphilitic diseases.

BEN, OIL OF. The expressed oil of the nut of the *Moringa aptera*. This oil is remarkable for not becoming rancid by age; and as it is perfectly insipid and inodorous, it is used for extracting the fragrance of certain flowers, such as jessamin, orange, &c. The same tree furnishes the *Lignum nephriticum*, supposed to be useful in certain affections of the kidneys.

BENE. The *Sesasum orientale.*

An annual plant of the family *Bignoniaceæ.* It is successfully cultivated south of Pennsylvania. The seeds abound in oil, which is readily expressed. They are very nutritious, and eaten by the Italians roasted, boiled, and made into flour resembling buckwheat. The oil is good, and may be substituted for common olive oil. The seed is sown in drills three or four feet apart, in April. The plant grows like cotton, and attains the height of four or five feet, bearing numerous seed-vessels, full of the small seed, which is not larger than flaxseed. The crop ripens gradually, and is taken in September; 15 to 20 bushels are given per acre, from which 40 to 50 gallons of oil may be obtained. The oil may be sold for $1 to $1 25 the gallon. Negroes are fond of the seeds in any form. The expressed oil-cake would be admirable food for fattening hogs and cattle.

BENOT. A double mould-board plough.

BENT GRASS. The genus *Agrostis*, the stem of which is much bent, and inclined to become creeping and subterranean. Creeping grasses are best exterminated from arable lands by heavy liming and the introduction of two or three crops of corn, or such other plants as are frequently tilled.

BENTS. Withered grass stems remaining in the pasture after the seeds have dropped.

BENZAMIDE. A compound of benzoyl and amidogene.

BENZOIC ACID. A vegetable acid found in balsams and some grasses.

BENZOIN. The concrete exudation of the *Styrax benzoin* of the East. It is a resin combined with benzoic acid.

BENZULE, BENZOYL. The hypothetical radical of benzoic acid and other compounds, formula $C_{14}\ H_5\ O_2 = Bz$.

BERBERRY. See *Barberry.*

BERGAMOT. The *Citrus bergamia.* Cultivated in the south of Europe for the fragrant oil of the rind of its fruit. The oil is volatile, and consists of 10C 8H. It is a species of lemon, and might be introduced into Florida.

The *Mentha citrata*, a common species of mint, easily cultivated, yields an oil nearly as fragrant as the bergamot.

BERMUDA GRASS, DOUB GRASS. *Cynodon dactylon.* A tall, repent grass, flourishing on sandy lands, and an object of cultivation in the South. It affords abundant pasturage for sheep, and binds together the loose soil. The levees of the Mississippi are planted with it. Many distinguished farmers on the south shores of the Mississippi speak highly of this grass; it is, however, difficult to eradicate. Mr. Affleck considers it most nutritious, and in his latitude (Washington, Miss.) it yields three cuttings, or from "five to eight tons of hay per acre from a moderately good meadow." It is destroyed by frost and propagated by roots, as it does not ripen seeds in his locality.

BERRY, or BACCA. In botany, a fruit filled with pulp, in which the seeds are imbedded, as the currant, gooseberry, &c.

BETEL. The leaf of an acrid narcotic pepper, chewed by the natives in the East Indies.

BETULA. The generic name of the birch family. The *populifolia* (white), *excelsa* (yellow) *rubra* (red), and *lenta* (black or cherry), are all fine trees, especially the red, the timber of which is much used for cabinet purposes; and the black or cherry, which has the colour of mahogany, and is both used here and exported to Europe. *B. papyracea*, or paper birch, yielded the bark for the canoes of the Indians. The wood of all is durable, and less affected by changes of temperature than most timbers. The juice of the European *B. alba* is sweet and easily fermented; it forms their birch wine. Various parts of the plant are put to a variety of economical uses; the bark forms paper, vessels, &c.; the twigs, brooms and rods, while the leaves are considered good fodder.

BEVEL. An instrument to take angles.

BEVEL GEER. In mechanics, a species of wheel-work, in which the axles of two wheels working into each other are neither parallel nor perpendicular, but inclined to one another in a certain angle. Wheels of this kind are also called conical, because their teeth may be regarded as cut in the frustum of a cone.

BI. From *bis*, twice, a common prefix to words meaning two, or twice, as bi-partite, bin-oxide.

BIBULOUS. Absorbent. In chemistry, blotting paper is often termed bibulous paper.

BIENNIAL. This term is usually applied to plants which grow one year and flower the next, after which they perish. Many biennials, if sown early in the spring, will flower in autumn and then perish, thus actually becoming annuals.

BIESTINGS. The first milk after calving.

BIFURCATE. Two-pronged, or forked.

BIGNONIAS. The trumpet flowers. *Bignonia radicans*, and other shrubby climbing plants, belong to this handsome genus.

BIGG. A winter barley.

BIKH. *Aconitum ferox*. A very poisonous Eastern monkhood.

BILABIATE. Two-lipped, or petalled, applied to flowers.

BILBERRY. Whortleberry.

BILE. The secretion of the liver. It is intended, according to Liebig, to prepare certain portions of matter to furnish fuel for the maintenance of the animal heat; any interruption in its production is attended with great lassitude, sickness, fever, and yellowness of the eyes and skin. Moist, marshy places, and food rich in oil, as butter and fat, produce bilious attacks. Calomel is the best medicine in these cases, 10 grains at first, and more if it does not quickly relieve. Fall and spring are the seasons most obnoxious to bilious attacks in new countries. Sometimes biliary calculi or stones are formed.

The composition of the bile is very complex, according to the analyses of some physiologists. Liebig, however, regards it as a natural soap, nearly consisting of choleate of soda.

BILL. A hatchet with a curved point.

BILLET. A small log or block of wood.

BIN. A box for corn, oats, &c.

BIND-WEED. A common name for most climbing plants, but especially directed to the convolvulaceous species.

BINES. Running stems.

BIOCELLATE. When an insect's wing is marked with two eye-like dots.

BIPINNATE. Leaves that are doubly pinnate; in which the secondary stalks or petals are pinnated.

BIRCH. See *Betula*.

BIRD. The preservation of birds as a means of destroying insects has lately attracted some attention. It is proposed to destroy the hawk tribe only, leaving crows, ravens, sparrows, wrens, bluebirds, and all others; for, although many of these occasionally take seed and injure fruit, they, for the most part, live on insects and small vermin, and the farmer is much more assisted by their labours than injured by their depredations. Mr. Swainson remarks that whereas numerous crops are devastated by insects, no one has ever heard of such evils being brought about by birds. To the apiarian the bee martin is, however, an unquestionable source of annoyance, although the same bird and all the genus are destructive to other insects.

BIRDLIME. A glutinous substance extracted by boiling the bark of the holly-tree; a similar substance may be obtained from mistletoe, from the young shoots of elder, and some other plants.

BIRD PEPPER. The small pepper, *Capsicum baccatum*, growing on a shrub: it yields the hottest Cayenne pepper. It is cultivated in Florida and the Indies.

BIRD'S FOOT TREFOIL. A European genus (*Lotus*) of small clovers, growing in pastures, and preserving their verdure in the hot weather from their long roots. They are inferior to clover, and, with the exception of *L. villosus*, which is an object of cultivation in France upon light soils, are never raised artificially. There does not appear to be any true species of this genus in the United States, and its inferiority to clover does not make it desirable to introduce them.

BIRD'S CHERRY. The *Prunus padus*. A small, wild cherry, indigenous in England.

BIRD'S MOUTH. In building, an interior angle or notch, cut across the grain at the extremity of a piece of timber for its reception on the edge of another piece; as a rafter, for instance, is received on a pole plate. Bird's mouth signifies, also, the internal angle of a polygon, its external angle being called a bull's nose.

BIRD'S NEST. Indian pipe. *Monotropa uniflora.*

BISEXUAL. In plants, having stamens and pistils in the same flower.

BISHOPING. A cant word for disguising the age of a horse.

BISON. See *Buffalo.*

BISTORT. The *Polygonum bistorta.* An acrid plant when fresh.

BISULCATE. With two fissures, two-hoofed.

BIT. The iron part of the bridle, which goes into the mouth of a horse.

BITTER ALMOND. A variety of the almond of a bitter taste.

BITTER PRINCIPLE. An obsolete term in chemistry, signifying that the dried juice of a plant contained a bitter ingredient. The bitterness does not depend upon any general principle, but upon a particular body, sometimes present in no other plant, as quinine, strychnine, &c.

BITTERN. The residue after evaporating sea water and removing the salt. It contains sulphate of magnesia and chloride of magnesia, as well as small quantities of soda, potash, and bromides. It would unquestionably be a valuable manure, and should be tried in small quantities wherever the opportunity offers.

BITTER SPAR. Crystallized dolomite. Carbonate of lime and magnesia.

BITTER SWEET. An extensive genus (*Solanum*), the berries of which, of a red and dark colour, are very poisonous.

BITUMEN. A mineral pitch. Several varieties, as petroleum, asphaltum, mineral tar, and naphtha, are distinguished.

BIXA. The genus yielding the *B. orellana* or arnotta.

BLACK. As a colour for horses, this is not preferred: there are said to be fewer good animals of this colour than any other. It is supposed that those of a high gloss and white legs are the best kind.

BLACKBERRY, or BRAMBLE. This term is generally used to indicate the *Rubrus villosus*, or common erect, and *R. trivialis*, creeping dewberry. The fruit is wholesome, and commands a good price in cities, so that near Boston they are cultivated. It makes excellent jam and preserves, as well as a good wine. The tall bramble is a good adjunct to the common rail fence in arable land; but its decaying branches injure meadows. In other parts of the field they are a serious nuisance, especially the creeping plant, and require grubbing for extermination, followed by a sufficient ploughing to break up the smaller roots. The roots are astringent.

BLACKBIRD. Notwithstanding his occasional depredations, he is a valuable friend to the farmer, by the destruction he makes among insects. The most common species is the *Quiscalis versicolor*.

BLACK CANCER. The decayed blotches on turnips.

BLACK DOLPHIN. The dark-coloured aphis, which injures beans, pease, cabbages, and numerous garden vegetables. Dusting with lime is a very valuable remedy, as well as cutting off the infested stems, when it is practicable, and burning them.

BLACK DYES. The substances used in dyeing blacks are logwood, weld or woad, fustic, sumach, gall-nuts, and oak apples, with copperas or sulphate of iron; but any other astringent may be introduced. The finest blacks are first dyed of a deep blue.

BLACK FLY. The small black beetle (*Haltica nemorum*) which infests cruciferous plants, and especially the turnip. See *Insects*.

BLACK GUM. *Nyssa multiflora.* A tree sometimes attaining fifty to seventy feet, and twenty inches in diameter. It grows south of Philadelphia. The wood is solid, and little liable to split; hence it is used for naves or hubs, and in ship-building for the caps of masts. The berries are dark, and relished by birds. The *N. aquatica*, or *tupelo*, is less in size, and grows as far as New-Hampshire. It is valuable as a dense wood, and used by carriage-builders.

BLACK LEGS and BLACK MUZZLE. See *Sheep, Diseases of.*

BLACK OATS, are more hardy, and ripen earlier than the common grain. They are otherwise inferior.

BLACK THORN. The European sloe (*Prunus spinosa*). Sometimes the *Cratægus flava* is called by this name in America.

BLACK TWITCH, or COUCH. *Agrostis alba.* Marsh couch grass.

BLACK WALNUT. See *Walnut.*

BLACK WASH. A lotion of calomel and limewater.

BLACK WATER. See *Sheep.*

BLADE. A shoot or spire of grass, wheat, &c.

BLADE BONE. The *scapula*, or broad bone of the shoulder.

BLAIN. In farriery, inflammation of the tongue, a disease in cattle, which frequently affects them in the spring of the year or beginning of summer. The disease is neither so frequent nor so fatal in the horse as it is in cattle; but it does sometimes occur, and the nature of it is frequently misunderstood. The horse will refuse his food, hang his head, and a considerable quantity of ropy fluid will be discharged from the mouth. On examining the mouth, the tongue will be found considerably enlarged, and, running along the side of it, there will be a reddish or darkish purple bladder, which sometimes protrudes between the teeth. The neighbouring salivary glands are enlarged, and the discharge of saliva is very great, while the soreness of the swelled and blistered part causes the horse obstinately to resist every motion of the jaws. The cure is very simple: the bladder must be deeply lanced from end to end; there will not be any great flow of blood This will relieve or cure the horse in twenty-four hours. If he can be spared from his work, a dose of physic will remove the stomach affection and any slight degree of fever that may have existed. If the disease is neglected, the swelling will at length burst, and corroding ulcers will eat deeply into the tongue, and prove very difficult to heal.—(*Clater's Farriery*).

BLANCHING. In gardening, the whitening of the stems, stalks, or leaves of plants, by tying them together, or earthing them up so as to exclude the light, and thus to diminish the intensity of their native properties and make them sweet.

BLAST. A flatulent disease of sheep.

BLASTEMA. The embryo.

BLASTING. The art of removing portions of rock by the explosion of gunpowder. For this purpose, a cylindrical hole is made in the rock in a direction corresponding with the strata, and of greater or less depth, according to the material. The diameter varies from one to one and a half inches, as the rock is harder. Into this is next placed a charge of powder occupying about one third of the depth, and furnished with a tin tube containing the fuse or slow match. After the powder, small pieces of rock or paper are rammed, and then sand is driven in, to fill the hole, and the extremity of the fuse lighted; the workman retires to a place of safety, and allows the explosion to take place. In this way boulders, which impede cultivation, and are too large to be lifted away, may be broken up, and the fragments removed for fences, &c. Stumps of large trees may also be torn up by blasting, the charge being contained in a tin case, and introduced beneath the stump; or the wood may be bored with an inch auger, and the charge inserted into the wood itself.

BLATTA. The cockroach genus.

BLAZE. A white mark or star in the face of a horse or other animal.

BLEACHING. This process consists in a series of operations, by which the natural colours of various substances are discharged so as to whiten them. It is effected either by the action of various solvents, aided by exposure to light, air, and moisture, upon the bleaching ground, or by the aid of chlorine. Cotton is more easily bleached than linen, in consequence of its being originally whiter, and having a less powerful attraction for the colouring matter. In bleaching these goods upon the old principle, warm water is first liberally applied to remove the weaver's paste or dressing; they are then *bucked*, or boiled in a weak alkaline lye; and after having been well washed, are spread out upon the grass, so as to be freely exposed to the joint agencies of light, air, and moisture; the bucking and exposure are alternately repeated, as often as necessary; the goods are *soured*, that is, immersed in water slightly acidulated by sulphuric acid; lastly, they are very thoroughly washed and dried. By these operations the texture of the goods is, to a certain extent, impaired, and much time is required to complete the process, which, also, cannot be carried on in the winter months. But the exposure upon the bleaching ground is now, to a great extent, discontinued; and the same effect is obtained, after the process of bucking, by the action of weak solutions of *chlorine*, or of *chloride* of lime, which, if skilfully used, can scarcely be said to injure the goods more than the long-continued exposure. The theory of bleaching has not been satisfactorily developed; but, from such experiments as have been made in reference to it, it appears to be a process of oxidation, and to depend upon some peculiar influence of *nascent* oxygen upon the colouring matter.

The colour of manufactured wool depends partly upon its own oil, and partly upon the applications made to it in the loom. These are got rid of in the fulling-mill by the joint action of fullers' earth and soap; the cloth is then well washed and dried, and is tolerably white; if the slight yellow tint which it retains is objectionable, it is prevented by adding a little stone blue to the washing water, or by exposure to the fumes of burning sulphur; this latter method, however, gives it a harsh feel, and if afterward soaped, its yellowishness returns.

The colour of raw silk depends upon a natural yellow varnish, which is got rid of by boiling it in white soap and water, and by repeated rinsings. Certain articles of wove cotton, such as stockings, are bleached as usual, and finished by the action of *sulphurous acid*, or the fumes of burning sulphur. Straw is also whitened by a similar operation; and hence bleached straw hats are apt to have a disagreeable sulphurous smell.

BLEACHING POWDER. Chloride of lime.

BLEEDING. An operation frequently necessary in the disorders of different kinds of cattle, particularly horses. Such horses as stand much in the stable, and are full-fed, require bleeding more than those which are in constant exercise; but especially when their eyes look heavy and dull, or red and inflamed; and when they look yellow, and the horse is inflamed in his lips and the inside of his mouth; or when he seems hotter than usual, and mangles his hay. These indications not only show that bleeding is required, but likewise lower diet. The spring is the common season for bleeding horses; but periodical bleeding should never be practised. In summer it is often necessary, to prevent fevers, always choosing the cool of the morning for the operation, and keeping them cool the remaining part of the day. Some farriers bleed horses three or four times a year, or even oftener, by way of prevention, taking only a very small quantity at a time, as a pint or a pint and a half. There is, however, this inconvenience from frequent bleeding, that it grows into a habit, which, in some cases, cannot be easily broken off without hazard; and, besides, horses become weak from frequent bleeding. The vein in the neck is usually opened, but that under the eye or in the leg is better, when the inflammation is near those parts.

BLEMISH. In farriery, any kind of imperfection in a horse or other animal.

In horses, blemishes consist of broken knees, loss of hair in the cutting places, mallenders and sallenders, cracked heels, false quarters, splents, or excrescences which do not occasion lameness; and wind galls and bog spavins, where they prevail to any great degree.

In forestry, the knots on the outside of trees, and shakes internally, are termed blemishes.

BLIGHT. A general term for the diseases of trees and crops, whether produced by temperature, moisture, insects, or parasitic fungi. See *Rust*, *Mildew*, *Smut*, *Plant Lice*, &c.

BLIGHT, AMERICAN. The *Eriosoma (aphis) lanigera*, or woolly plant lice; they infest the apple and pear tree occasionally.

BLIND, MOON. Cloudiness of the eye, ending in cataract.

BLINDNESS. A deprivation or want of sight, originating from various causes; a complaint more frequent in horses than in neat cattle or sheep.

Blindness in horses may be discerned by the walk or step being uncertain and unequal, so that they dare not set down their feet boldly; but when they are mounted by an expert horseman, the fear of the spurs will frequently make them go resolutely and freely, so that their blindness can hardly be perceived. Another mark by which horses that have lost their sight may be known is, that when they hear anybody enter the stable, they prick up their ears, and move them backward and forward in a particular manner.

Blindness in Sheep.—A complaint that sometimes occurs in these animals from their being much exposed to either great dampness or long-continued snows.

BLINKERS. The leathers attached to the bridle of carriage-horses to direct their sight forward.

BLISTERING. In farriery, the operation of stimulating the surface of some part of the body of an animal, by means of acrid applications, so as to raise small vesications upon it. It is frequently employed for the purpose of removing local affections of different kinds, such as hard, indolent tumours.

BLISTER FLY. The bright green and golden fly usually employed is the *Cantharis vesicatoria*, imported from Europe; but there are several insects indigenous which possess equal power, as the potato flies (*C. vitata* and *cinerea*) and the black cantharis (*C. atrata*).

The potato flies are seen in August, morning and evening, among the foliage of the potatoes; the head is red, and the back black, with a yellow stripe; and in the *cinerea* the whole is black, with a gray hair, or down. The wing cases (*elytra*) are hard. They are shaken off the vines, killed by being thrown in hot water, and then dried in the sun. When well dried, they keep for years in closed bottles.

BLISTER LIQUID. A liquid composed by adding a gallon of spirit of turpentine to a pound of powdered flies, and macerating the whole for a month, when the clear fluid will form a strong liquid blister. If so powerful an external stimulant be not required, this liquid may be diluted with an equal part of spermaceti oil.

BLISTER OINTMENT. One ounce of powdered blistering flies; four ounces of lard. One ounce of this, well rubbed in, is sufficient to blister a horse's leg.

BLOOD. The fluid which circulates through the body, giving nourishment to all parts. It consists of albumen, fibrin, red globules, fatty matters, water, and saline substances. As a manure, its importance depends on the large quantity of ammonia it exhales. It is always preferable to use it in compost, with ashes, charcoal, fine earth, and vegetable matters. Its effects are principally stimulant when used alone. The composition of blood is nearly identical with that of flesh.

BLOOD-ROOT. *Sanguinaria Canadensis*. This root is of a red colour.

BLOOD-SHOT. In farriery, a popular term for that red appearance which the eye exhibits when inflamed. The best treatment is to bathe the eye with a lotion composed of one drachm of white vitriol (sulphate of zinc) dissolved in half a pint of water.

BLOOD SPAVIN, or BOG SPAVIN. In farriery, a swelling of the vein that runs along the inside of the hock of the horse, forming a soft tumour in the hollow part, often attended with weakness or lameness of the hock. Clater (*Farriery*, p. 272) says, a blister is the proper application.

BLOOM, or BLOSSOM. The flower, in the most perfect state, consists of an outer green envelope (*the calyx*), in the interior of which are the coloured leaflets (*petals*), surrounding a number of thread-like bodies (*the stamens*), and containing a central body or pistil. Of these parts, the stamens and pistils are essential, although they do not always grow in the same flower. The calyx and petals (*corolla*) serve only to protect the inner organs from rain, which destroys their function when excessive. Other plants, however, have none of the envelopes, but are furnished with especial means of preserving the stamens. The name of a plant is, for the most part, known by the figure of its blossoms. Large numbers of genera possess flowers of the same kind, and are constituted into Natural families; as the Caryophyllaceæ, with flowers like the *pink;* Rosaceæ, with flowers like the single rose; Cruciferæ, with flowers like the radish; Umbelliferæ, with flowers like the parsnip, &c.

BLOW FLY. The *Musca carnaria*. It deposites eggs upon meat, which in a few hours become maggots, and hasten the decay rapidly; gauze cloths are used to keep them off; salt or Cayenne pepper serves as a preventive, by indisposing the fly to lay eggs on surfaces smeared with them.

BLOWN. In farriery, a diseased state of the stomach and bowels of cattle, caused by the sudden extrication of air in large quantities from some of the grosser kinds of green food. See *Hoven*.

BLUBBER. The cellular substance in which whale oil or fat is stored. It is often used with advantage in composts of ashes and peat, and yields ammonia during decay.

BLUEBIRD. *Sylva sialis*. A familiar insectivorous bird that should be encouraged on farms.

BLUE DYES. These are indigo, Prussian blue, logwood, bilberry, mulberries, elder-berries, privet-berries, and some other berries whose juice becomes blue by adding a little alkali. Indigo, Prussian blue, and logwood are principally used, and are prepared for the purpose. When the berries are used, one pound is boiled in water and mixed with one ounce of alum, of copperas, and of blue vitriol, and the stuffs passed through sufficiently often to acquire a proper colour.

BLUE GRASS. The valuable perennial Kentucky grass, or *Poa pratensis*, is considered the best indigenous grass of the United States. It forms a thick, dense sward, yielding a fair amount of very nutritious hay. It is adapted especially for permanent hillside meadows, growing well in a drained soil. Half a bushel of seed is sown either with a fall crop or with oats in spring: it is customary to mix clover or timothy with it, which furnishes grazing sooner, and preserves the young grass. In two years it takes entire possession, and forms a close mat of delicate herbage. It flourishes well in New-York State and far to the south. In Kentucky they sometimes grow it in wood land as well as in open pasture. The wood blue grass is a variety (*P. sylvestris*).

There is another grass (*Poa compressa*), also called blue grass, and common in the Northern States; but it is scanty, and very inferior to the rich Kentucky kind.

BLUE STONE and BLUE VITRIOL. The sulphate of copper. It is used as a caustic to sores, and as a steep for wheat, to save it from smut.

BOG. This term is commonly used in agriculture to designate a hole or morass containing much vegetable mud or muck; often the deposites are extensive, and many feet deep. A peat bog contains peat chiefly.

When bogs become consolidated or compressed, they are called peat mosses. See *Peat*.

BOG EARTH. This earth often contains twenty or thirty per cent. of vegetable matter, and when well broken with lime, and by exposure to air, forms a rich soil.

BOIL, or, commonly, BILE. A tumour containing matter, or pus. It is the result of local inflammation. It should be brought to a head by poultices of flour or linseed, and, when soft and fluctuating, opened freely with a lancet. The wound should be kept clean, and closed with sticking plaster, or protected by a rag.

BOILING POINT. The temperature at which fluids boil. Thus, water at 212°, alcohol 176°, oil of turpentine 316°, æther 96°, mercury 662° Fahrenheit.

BOLE, or BOLL. A Scotch measure of four bushels.

BOLE OF TREES. The trunk.

BOLETUS. Fungi, forming fleshy masses, attached to the trunks of trees, and filled with holes on the lower side. One species, *B. bovinus*, is said to be eaten by cattle. The *B. ignarius* and *fomentarius*, dried and prepared with saltpetre, forms the German tinder, or amadou.

BOLTER. A sieve used to separate bran from flour or meal, urged by machinery in grist mills. For coarse purposes, wire-work is sometimes used; but bolting cloths for flour are of linen or hair, and of several degrees of fineness.

BOLT-HEAD. A glass vessel, or flask, used in the laboratory.

BOLTING FOOD. This is a practice which brings about indigestion in animals as well as in men, and must be hindered by feeding the animal separately, and at shorter intervals, and using chopped food or meals.

BOLUS. See *Ball*.

BOMBAX. A genus of large trees producing a short cotton.

BONES. The frame-work of the higher animals. Bones consist of fifty-six per cent. mineral, and the rest gelatinous and destructible matter. The mineral portion contains, on an average, fifty per cent. of phosphate of lime, or bone earth; of this, twenty-four per cent. is phosphoric acid, and the rest lime. The destructible animal matter is partly removed by long boiling, and used as a size.

The value of bones as manure arises from the combination of animal matter and phosphate, but is chiefly due to the latter. They are applied usually in coarse powder, ground at suitable bone mills, which are now to be found near all our large cities. The price in Baltimore and New-York is forty cents the bushel. Sometimes, pieces, or broken bones, from half an inch to an inch long, are used as a permanent dressing.

The amount of dust to be applied

per acre is ten or twenty bushels for five years' rotation, or, in composts, two or four bushels annually. The effects are most remarkable on sandy and light soils; but all lands are improved by it when the addition is indicated. The test, when bones are necessary, is easily discovered; for soils which produce defective grain are always much benefited by them.

The value of bone dust arises from the fact that all seeds contain a large quantity in their ashes, and the soil is naturally but poorly supplied. Seed crops are well known to exhaust lands rapidly, and chiefly because they remove the bone earth or phosphates of the soil. Those lands which are well furnished with this substance naturally produce rich clover and wheat: such are marls, some secondary limestones, and stiff clays, and show less the application of bones.

The dust is to be scattered with seed, and not ploughed in deep; for it has a tendency to sink naturally, and as it is very slowly dissolved by rain water, it should not be placed out of the reach of plants. Compared with farm-yard manure, one bushel is equivalent to three cart loads, wherever it is well applied.

All plants, the shells of lobsters and eggs, and the fine shell marl of ponds contain bone earth; and in Spain a mineral is extensively found consisting of nearly pure phosphate of lime; but the principal source is from bones. Guano often contains twenty-five per cent. of phosphates. The action of this substance, in whatever combination it may exist, is always the same.

Bones which have been boiled before grinding are very little inferior to the recent, except when applied to very poor soils, where the putrescent animal matter is required. Recent bones are best for turnips, cabbages, and similar crops; but the boiled variety answers for grass, grains, pease, beans, &c., the manure being adapted for every crop cultivated for seeds.

BONES, DISSOLVED. For the purpose of obtaining the full action of bone dust in the shortest time, it is dissolved in oil of vitriol (sulphuric acid) or in muriatic acid. The strong acids are used for this purpose at the rate of fifty to sixty pounds of acid to two bushels of dust. The acid should be slightly diluted if it blackens the bones. They should be stirred with a wooden stick, and the operation conducted in a large crock of coarse earthen-ware. The great causticity of the acid renders it a nice process. The solution should be taken up with fine soil or mould, and one half applied to an acre as a top dressing, care being always taken that before use it has lost its acid qualities.

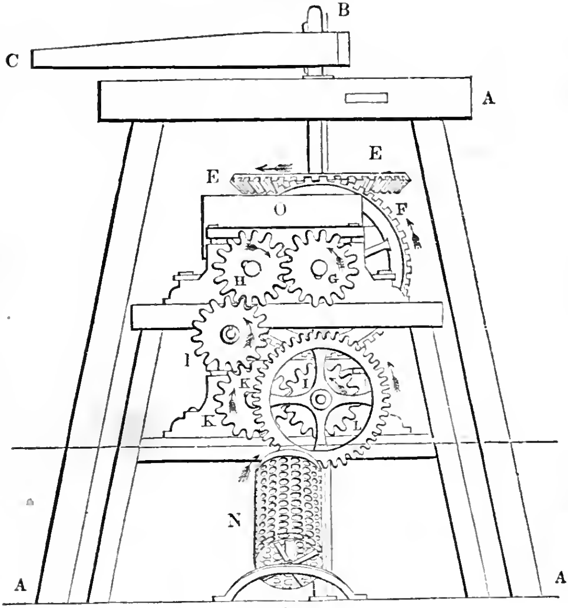
In this way a soluble phosphate of lime and sulphate of lime are formed: the latter remains at the bottom of the vessel, and is a fine plaster of Paris; it should be stirred up with the mixture when the soil is added. When fresh bones are used, the gelatin also thickens the solution. This preparation of bones is now superseding the common application in England and Scotland for turnips. When employed, it should be sown with the seed, or used as a top dressing to young plants. It will be found an admirable ingredient for composts intended to bring forward seed crops.

BONE EARTH. Phosphate of lime chiefly.

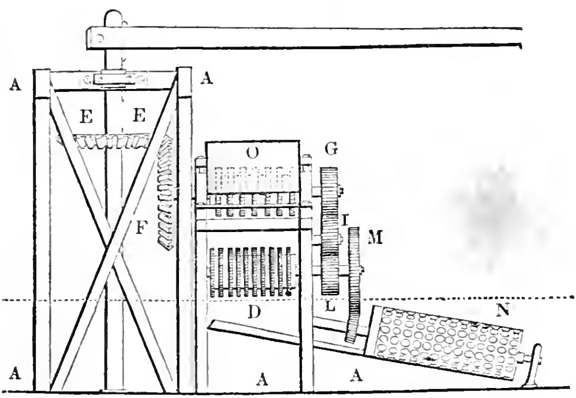
BONE MILL. The following account of a mill for breaking bones into small fragments is from Mr. Rham:

The mill to break and grind bones consists of two iron or steel cylinders, with grooves running round their circumference, the projections being cut so as to form strong teeth. These turn upon one another by means of machinery, so that the teeth of one run in the groove between the teeth of the other, as may be seen in the annexed cut.

The bones put in the hopper, O, are seized by the teeth of the two upper cylinders, and broken in pieces, which fall in between the lower pair, where they are reduced to a smaller size. From these they fall on a slanting board, D, and slide into the wire cylinder. All the smaller pieces pass



Front elevation.



Side elevation.

through the interstices of the wire; those which have not been sufficiently broken come out at the end, and are returned into the upper hopper. Where a machine of this description can be attached to a water or wind mill, or to a steam-engine, the bones are broken at a small expense; when horses are used the expense is greater; and a hand mill can only be of use where there is a great superabundance of manual labour, and only a small quantity of bones required.

A A is the frame of a bone mill strongly fixed to the floor; B, the axis of the machinery, which is turned by the lever C C, to which the power is applied; E E is a horizontal wheel with bevelled teeth moving a vertical wheel, F, on the axis of which one of the cylinders with grooves and teeth is fixed. At the other end of the axis is a smaller wheel, G, turning a similar one, H, on the axis of the other cylinder, making the toothed surfaces turn towards each other, and thus crushing between them the bones which the hopper, O, supplies. Another pair of cylinders, similar to the first, but with smaller teeth, are turned by means of the intermediate wheel, I, working in the wheel, L, fixed to the axis, on which is a larger wheel, M, working in a pinion which turns the cylindrical sieve, N. The arrows indicate the direction of the motion.

BONE SPAVIN. A disease of the hock joint in horses, brought on by over exertion. While forming there is continued lameness. Blisters and rest sometimes effect a perfect cure. Spavined horses are useful for slow work; they are most inconvenienced in the act of rising.

BORAGE. *Borago officinalis.* A rough weed growing two feet high. It is used as a fallow crop in Germany, and, according to Lampadius, contains nitre. It seems to be admirably adapted for this purpose.

BORAX. Borate of soda, used as a flux in welding steel, &c.

BORDER. In gardening, the edges of beds. They are frequently well trenched and manured, so as to be made the richest parts of the garden; hence, when we are directed to plant in borders, it is usually meant that deep, good soil, and free space are required.

BORECOLE, or KALE. A species of winter cabbage with divided leaves and open heads. The principal varieties are, *Green Scotch Kale*, *German Curled*, *Purple*, *Jerusalem*, *Cæsarean Kale*, and *Thousand-headed Cabbage*. The last two grow to four feet, and yield large numbers of sprouts.

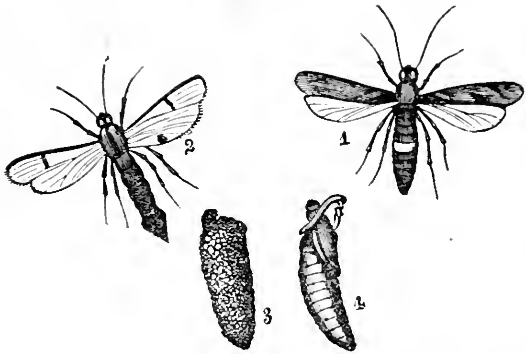
The seed is sown in May; plants are set out in July. They will be found best after slight frost, and may be kept like cabbages during winter. The stocks, in spring, send out abundant tender shoots. An ounce of prime seed will yield nearly four thousand plants. They are so inferior to other plants of the cabbage kind as to be scarcely worth cultivation.

BORERS. Beetles and other insects, the worms of which burrow into the bark, wood, or roots of trees. There is a large number of genera and species, some peculiar to one tree or shrub, others common to several. The perfect beetle is usually seen in June and July, either about the trunk, or searching for food in flowers, &c. Their place while buried in the tree is known by the holes they leave through the bark. They reside often two years in this way as worms and grubs. Where woodpeckers are encouraged in orchards, the trees are kept pretty free from their ravages; but in New-England they do much damage, and are sought for, and destroyed by iron wires, small augers, and other direct means. Catching the mature beetle is much more advantageous, and taking care to have the bark well cleaned, and washed with whale oil soap, lime-water, pitch, strong lye, &c., at the time the eggs are deposited in July. The eggs are usually deposited on the trunk near the ground.

Many of the borers belong to the Capricorn family, having long antennæ. The following figures represent two common borers. *A*, the female apple-tree borer. *B*, the peach-tree borer.

A. Apple-tree Borer (*Saperda bivittata*).

The locust, and all the varieties of pine and fir trees, are severely



B. Peach-tree borer (*Ægeria exitiosa*). 1, female; 2, male; 3, case in which the pupa (4) is enclosed.

infested with peculiar borers. These also deposite their eggs about July.

BORING. In draining, rods are frequently thrust into the subsoil for the purpose of ascertaining the nature of the earth, or the existence of water or springs. See *Auger.*

BOS. The generic name of ruminating quadrupeds, having the characters of the ox and buffalo. The origin of the domestic ox is unknown.

BOTANY. That department of knowledge which investigates the forms, varieties, and functions of plants in a natural state. It is derived from *βοτανη*, an herb.

Structural botany, or Organography, details the figures of the different parts of plants, both internal and external. We learn from this department that the interior of vegetables is either made up of small cells, resembling the cavities of the honeycomb (cellulares), or consist also of tubes and veins, as the higher plants (vasculares). The cells are destined either to store up starch, wood, resins, or other products of vegetation; the tubes to convey sap and fluids. In a complete system of organography, the minutest shades of difference between leaves, roots, &c., are detailed with uninteresting prolixity.

Physiological botany teaches the use of the leaf, root, flower, seed, &c. It will be fully illustrated under the various parts of the plant.

Descriptive botany is that portion of the science which is devoted to describing and recognising plants. In this there are two methods of procedure, the Linnæan and Jussieuan: the former is the simplest, the latter the most perfect, and will be introduced in the cases of the leading agricultural families, as the bean tribe, cabbage tribe, &c.

To understand Linnæus's classification, it is necessary to state that perfect flowers consist of four parts: 1st, an external green or coloured wrapper seen on the bud, called the *calyx*, consisting of one or more leaflets; 2d, an inner similar system of flower petals, called the *corolla*; 3d, a number of thread-like bodies carrying a head; these are the *stamens*, the head being called the anther; 4th, a central thread-like body, single, or divided into several parts, called the pistil, whereof the extremity is the stigma. The pistil is only the upper part of the young fruit, or ovarium. In all these points there is much diversity: sometimes neither calyx nor corolla is present; again, the stamens, which are also considered the male organs of the flower, may be in one plant, and the pistil, or female organ, in another, or in different parts of the same plant. It is well known that unless the yellowish dust, or pollen, given off by stamens can reach the stigma, no seeds are formed, and that fruit is only produced in female plants, or such as contain the pistils. Linnæus divided the vegetable world according to the number of stamens and pistils in the flower; so that, to know to what tribe a specimen belongs, we have only to count these parts, and search for the name in the proper works under the general division ascertained.

These divisions are also called classes and orders, the first being constructed from the number and position of the stamens, the orders by the number, &c., of the pistils. Every plant, therefore, belongs to a class and order, unless it be diæcious. The classes are as follows:

Class.		Styled.
I.	1 stamen	Monandria.
II.	2 stamens	Diandria.
III.	3 "	Triandria.
IV.	4 "	Tetrandria.
V.	5 "	Pentandria.
VI.	6 "	Hexandria.
VII.	7 "	Heptandria.
VIII.	8 "	Octandria.
IX.	9 "	Enneandria.
X.	10 "	Decandria.
XI.	12 to 19 stamens	Dodecandria.
XII.	20 or more stamens, inserted into the calyx	Icosandria.
XIII.	20 or more stamens, inserted into the receptacle	Polyandria
XIV.	2 long and 2 short stamens	Didynamia.
XV.	4 long and 2 short stamens	Tetradynamia.
XVI.	stamens united into a tube	Monadelphia.
XVII.	stamens united into two parcels by filaments	Diadelphia.
XVIII.	stamens united by their filaments into several parcels	Polyadelphia.
XIX.	stamens united by their anthers into a tube	Syngenesia.
XX.	stamens united with the pistil	Gynandria.
XXI.	stamens and pistils in separate flowers, but on the same plant	Monœcia.
XXII.	stamens and pistils in separate flowers and on separate plants, one male, the other female	Diæcia.
XXIII.	stamens and pistils, separate in some flowers and united in others, either on one plant or on two	Polygamia.
XXIV.	stamens and pistils not clearly developed	Cryptogamia.

The orders are as follows:

1 style or stigma	Monogynia.
2 styles or stigmas	Digynia.
3 " "	Trigynia.
4 " "	Tetragynia.
5 " "	Pentagynia.
6 " "	Hexagynia.
7 " "	Heptagynia.
8 " "	Octagynia.
9 " "	Enneagynia.
10 " "	Decagynia.
12 " "	Dodecagynia.
More than 12 styles	Polygynia.

Besides these, which are ascertained by simple enumeration of the styles, Linnæus divided some of the classes below the thirteenth into peculiar orders. Thus,

The orders of the class Didynamia are two: 1st. *Gymnospermia*, in which the seed vessel or ovary is divided into four lobes, each giving one style or pistil, and containing one seed; 2d. *Angiosperma*, with a perfect ovary, two-celled, and many-seeded.

In class fifteenth, Tetradynamia, the orders are: 1st. *Siliquosæ*, plants with long pods, as the cabbage; 2d. *Siliculosæ*, with short pods.

Class nineteenth, Syngenesia, is divided into five orders: 1st. *Polygamia æqualis*, each flower of the collection is furnished with stamen and pistil; 2d. *Polygamia superflua*, the florets round the circumference or disc hermaphrodite, but the central female only; 3d. *Polygamia frustranca*, the disc florets hermaphrodite, the central steril; 4th. *Polygamia necessaria*, the florets of the rays or circumference male, those of the centre female; 5th. *Polygamia segregata* has several florets, either simple or compound, but with a proper calyx, included within one general calyx.

Class twenty-third, Polygamia, is divided into two orders, as the plants are monæcious or diæcious.

In Cryptogamia there are five orders, which are, however, in no way connected with the female organs: 1st. *Filices*, or ferns; 2d. *Musci*, or mosses; 3d. *Hepaticæ*, or liverworts; 4th. *Algæ*, or sea-weeds; and, 5th. *Fungi*, or mushrooms.

To discover the name of any plant,

or ascertain if it agrees with a particular description, the first step is to learn how many stamens it contains; this gives us the class. Under this head, in the Flora (*Eaton's, Torrey's, or any other dictionary of plants*), we find a certain number of orders: the place of the plant among these is known by examining the pistils. Thus we have reached the class and order under which will be arranged a description of all the known or common genera; these are to be read carefully, each point of structure being compared with the specimen; thus the genus is known, and under this the species are found, which usually differ in the form of the leaf and stem.

The following general view of the vegetable kingdom is an introduction to the natural ystem of Jussieu, improved by Dr. Lindley and others:

PLANTS.

According to their Fruits and Flowers.		*According to their Development.*
I. Having flowers and sexes (*Phanerogamous*)	or	Their stems (axis) increasing symmetrically in density and breadth, as well as in length (*Pleurogens*).
(*a*). Least number of seed lobes (*Cotyledons*) 2	or	Stem in concentric bands (*Exogens*).
Class 1. *Dicotyledons* (2 seed lobes always)	or	*Veins of leaves netted.*
2. *Gymnosperms* (seeds naked)	or	*Veins of leaves netted or forked.*
(*b*). Least number of seed lobes, 1	or	Stem a confused mass of cellular tissue and wood.
Class 3. *Monocotyledons* (1 seed lobe)	or	*Veins of leaves parallel, and not netted.*
(*c*). *Acotyledons*	or	Vegetation like mushrooms.
Class 4. *Rhizanths*	or	Fungoid flowers.
II. Having neither flowers nor sexes .	or	The stems, or axis, increasing by simple elongation, or irregular expansion.
Class 5. *Cryptogamic plants* . .	or	*Acrogens.*

BOTRYOIDAL. From βοτρυς, a bunch of grapes. In botany, any flowers, &c., clustered together.

BOTS. A family of two-winged or dipterous insects, the larvæ or maggots of which infest the intestines, wounds, &c., of domestic animals. The maggots are whitish and conical, of half an inch or more in length, and adhere with great force to the maw of horses, &c. They are taken into the stomach in the form of eggs, which the insect lays on the knees (*Gastrophilus equi*) and other parts of the animal, which, being bitten off, are swallowed, and developed in the body. The animal attacked looses appetite, becomes restless, bites his sides, coughs, becomes stiff in the neck, staggers, breathes with difficulty, and may die in the worst stages.

They are to be hindered by ordering the groom to remove the eggs in the fall, as soon as they are laid. It is also advisable, as a preventive, to administer, in the spring, a quart of milk with a good dose of molasses, and, shortly after, a quarter of a pound of Glauber salts, by which the bots are pretty freely evacuated.

Sheep are pestered with a bot fly (*Cephalemyia ovis*), which deposites its eggs in the nostrils; the worms hence crawl into the upper parts of the nose and produce great irritation.

BOTTOM. In horsemanship, endurance.

BOTTOM HEAT. In horticulture, heat produced by fermenting dung, leaves, bark, &c., applied under beds of earth, &c., for raising or forcing plants requiring a temperature higher than that of the air.

BOUND. In veterinary medicine, a term applied to the bowels, to indicate want of natural action; to the skin or hoof, to indicate tightness or constriction. A tree is said to be bark bound when the bark cracks and is constricted.

BOULDER. A massive rock, dissimilar from the adjacent rocks in mineral character, and supposed to have been transported by great floods, icebergs, &c.

BOUT. In ploughing, one course of the plough.

BOWEL DISEASES. The most prominent are inflammations. These are of two kinds, of the interior and of the outer membrane of the intestines. The first is produced by bad food, inattention to diet, and is attended with a hot skin and purging; the animal is in some degree weakened, but may be restored by the use of moderate bleeding; gruel is also administered with soothing medicines and astringents: it is seldom fatal. The second kind (peritonitis) is extremely violent; it is brought on by sudden application of cold, when heated, to the stomach, as in passing a small stream in winter, &c. In farriery it is called the red colic, and is often fatal in twenty-four hours. The animal paws violently, is extremely sensitive over the stomach, struggles, groans, lies on his back, is costive, the legs and flanks are cold, he shivers involuntarily, and sweats. These violent symptoms soon subside, and he becomes so weak and anxious as scarcely to stand. As soon as the disease appears, copious bleeding must be had to produce almost fainting, blistering fluid must be well rubbed over the skin of the stomach, and Glauber salts given. He should be kept quiet, and clothed. This treatment will soon show its good effects, after which he must be fed scantily, and kept warm and quiet.

BOX DRAIN. A drain with square sides, presenting the section of a box: it is usually of tiles or bricks.

BOX-TREE. The *Buxus sempervirens* and *balearica* produce the dense yellow wood used by engravers, and also for making rules, combs, buttons, flutes, &c. The best wood is obtained from Southern countries, as Spain and Turkey. The dwarf box is a variety of *B. sempervirens*.

BOX OF WHEELS. The iron cylinder in which the axis turns.

BRACCATE. Bracca, *breeches*. In ornithology, when the feet are concealed by long feathers descending from the tibiæ.

BRACHALYTRA from βραχυς, *short*, and ελυτρον, *sheath*). The name of an extensive group of coleopterous insects, including all such as have the elytra so short as not to exceed one third the length of the abdomen.

BRACHINUS. A genus of coleopterous insects, now the type of a family (*Brachinidæ*), including those singular beetles which, from their defensive anal explosions, are termed "bombardiers."

BRACHIUM. The lower portion or forearm of the fore extremities.

BRACT. In botany, the small leaflet situated under the flower. The flowers of grasses, sedges, &c., are bracts which receive the names of glumes and paleæ.

BRAIRD. In Scotch books, the starting of young seedlings.

BRAKE. An implement to bruise flax and hemp. The wooden pincers used by coopers and others. The snaffle used with horses. A large harrow.

BRAMBLE. The genus *Rubrus*. See *Blackberry*.

BRAN. The outer membrane of wheat, &c., rubbed off in the mill. When first used, bran produces a laxative effect on horses and other animals. For milch cows and calves it is an admirable fodder, in consequence of the large amount of bone earth it contains; it is fattening, as it yields four per cent. of oil. As a general article of food, Boussingault makes nine pounds equal ten pounds of prime hay. The quality of bran will, however, differ with the economy of the miller. From good wheat, well bolted, there should not be more than seven per cent. of bran.

BRAND IN CORN. See *Burned Ear*.

BRANDY. Liquor distilled from the dregs of wine: it contains fifty per cent. alcohol; the colour is fictitious, as the spirit is nearly transparent. Burned sugar is the usual colouring matter.

BRASSICA. The generic name of the cabbage, rape, broccoli family; they belong to the *Cruciferæ* of Jussieu, and *Tetradynamia siliquosa* of Linnæus.

BRAWN. The salted and prepared flesh of the wild boar.

BREAD. There are three varieties extensively used in the United States, wheat, corn, and brown or Graham bread. Wheat bread is leavened, or rendered light and spongy by yeast, which is worked into the dough, and communicates to the starch of the flour, at a temperature above 60° Fahr., a fermentation called the panary fermentation, in which sugar and alcohol are formed in small quantity, and the gluten of the flour diminishes even to two per cent. In these changes, carbonic acid gas is given off, and, rising through the dough, produces the cellular texture. When the process goes on too long, vinegar is produced, and the dough becomes sour. The heat of the oven stops the panary fermentation, and hinders farther change. Town bakers, by using every expedient to accumulate gas in their loaves, produce a spongy, tasteless bread.

Corn bread contains no gluten, and will not rise with yeast. It is merely mixed with enough water to be almost as soft as sticking paste, and baked at once.

Graham bread is commonly bread containing a little bran, but sometimes bi-carbonate of soda and salt are added.

BREAD FRUIT. *Artocarpus incisa.* A tree of the Eastern Archipelago, now cultivated in the West Indies also, the fruit of which, cut into slices and roasted, resembles bread, and is much used as a substitute.

BREAD ROOT. The *Psoralia esculenta*, and other species, indigenous in Missouri and throughout the West. The roots are eaten boiled and raw by the Indians. They are of a tenacious, solid structure, and insipid.

BREAKING. The education of horses and other animals. It should not commence too young, or they want spirit; or too late, or they become unmanageable.

BREAKING UP. The ploughing of leys.

BREASTING. Breasting up a hedge is cutting the face of it on one side, so as to lay bare the principal upright stems of the plants.

BREASTPLATE. A strap running across the chest of the horse, to hold the saddle tight.

BREAST PLOUGH. A large spade or shovel, the handle of which is furnished with a cross-piece, against which a man presses, and drives the implement forward through peat or turf, cutting off long slices. It is used chiefly in paring turf to be burned for improvement.

BRECCIA. A conglomerate formed with angular fragments of stones. Some are calcareous, others silicious.

BREECH WOOL. The coarse short wool of the breech of common sheep.

BREECHING, or BREECHIN. That part of the horse's harness attached to the saddle, and hooked on the shafts, which enables him to push back the cart or other machine to which he is harnessed.

BREED. A variety among animals.

BREEDING. The following is from Mr. Rham:

Breeding is the art of multiplying the domestic animals rapidly, and, at the same time, improving their qualities.

Any breed of animals will perpetuate itself, provided there is a sufficiency of proper food for them; and the varieties found in a wild state must depend in some degree on the climate and the products of the country in which they are found. Care and domestication also produce va rieties which are much more useful or profitable than the wild breeds; and in the selection of the best individuals to propagate a useful race, and in the rearing of the young, consist the art of the breeder.

Without entering into particulars, which vary with every species of animal, and with the different varieties of the same species, we shall lay down certain principles which experience has proved to be correct, and which, being attended to, will greatly promote the improvement of all the different animals usually bred for the use of man, whether for his sustenance or for his pleasure. The first thing which is to be kept in view is the chief purpose for which the animal is reared, whether for labour, strength, or for speed; whether merely for a supply of animal food, or to produce the raw materials of manufacture. In each of these cases distinct qualities are required, and it is seldom that two of these objects can be combined in the greatest perfection.

Having then determined the purpose for which any species of domestic animal is designed, every quality must be attended to which furthers this view; and, except under very peculiar circumstances, the animals intended to keep up the stock by their produce must be chosen with those qualities in the greatest perfection which are essential to the end. In all animals a perfect conformation of the bodily frame is essential to the due performance of the vital functions. The skeleton of the animal should therefore be as perfect as possible. The capacity of the chest, and the healthy nature of the lungs, are points which must never be overlooked, whatever may be the purpose for which the animal is bred; for although a defect may be in some measure counteracted by a judicious choice of the individual coupled with the defective animal, it is only where there is no alternative or choice that any defect in the bodily frame of an animal kept for breeding should be overlooked. In spite of every care, the defect will appear in the offspring; sometimes not till after several generations. If it were possible to find individuals without fault or defect, no price would be too great for them; and for those that have been carefully selected for several generations, it is real economy to give a very liberal price. In horses bred for racing or for the chase experience has fully proved the truth of this rule; and no one who pretends to breed race-horses would breed from a mare which had a natural defect, or a horse whose whole pedigree was not free from fault. For mere swiftness, the shape of the animal, whether horse or greyhound, must combine strength with great activity. The chest must be deep, the lungs free, and the digestive organs sound but small, to add as little weight to the body as is consistent with the healthy functions of nature. The legs should be long and slender, and the bones compact and strong; but the principal thing to be attended to is the courage, and no quality is so hereditary. A horse or hound of a good breed, if in health, will die of exertion sooner than give up the chase. Any defect in courage in an animal intended for great occasional exertion renders him unfit to be selected to continue an improved breed; and, whatever may be his pedigree, he has degenerated.

With respect to animals whose strength and endurance are their most desirable qualities, a greater compactness of form is required, a greater capacity of the digestive organs, and, according to the climate to which they may be exposed, a more suitable covering. Whether it be to ward off cold or great heat, a thick covering of hair is equally serviceable in both cases. Hardiness of constitution is hereditary, like other qualities; and the manner in which the young are reared tends greatly to confirm or diminish this. An animal of which the breed originally came from a warm climate, like a tender exotic plant, wants artificial warmth for the healthy growth of its limbs; while the indigenous and more hardy breeds may be left exposed to the elements. An abundance of wholesome food and pure water is essential to the healthy state of every animal, as well as exercise proportioned to its strength. These are circumstances which it is obvious must be carefully attended to. There are others, the result of long experience, which are equally necessary to be known, but which are not so obvious. These vary according to the species and variety of the animals bred, and it is seldom that the same breeder is equally successful in rearing different species of animals.

In the animals selected to breed from, there are *points*, as they are called, which are peculiar conformations, some of which are connected with the natural formation of the skeleton, and others appear to be the result of an association derived from the known qualities of certain individuals. That high withers and a freely-moving shoulder-blade in a horse are connected with his speed, is readily perceived, and that the length of the muscles of the quarter, and the manner of their insertion, should affect his power, is equally evident; but it is not so apparent that the manner in which the ears are placed on the head, the shape of the nose or jaw, and the insertion of the tail higher or lower, has an important effect on the value of the animal, independently of any arbitrary idea of beauty. A breeder who should not attend to these circumstances in the animals chosen to perpetuate the breed would find, to his cost, that it is more than mere taste which has determined these points. It is the result of observation and experience that certain breeds are invariably distinguished by certain peculiarities, and that these are almost as invariably connected with good qualities, apparently quite independent of the parts on which these points appear.

There is an indication of the disposition of an animal in the eye, in the shape of the head, and in the manner in which it is carried, which seldom deceives an experienced judge. He will not risk introducing a vicious or sulky disposition into his breed, which might counterbalance all the good qualities the animal might possess, and introduce a greater hereditary fault than any imperfection of form.

But nothing is so deceitful as the prejudices which exist with respect to peculiarities and colours. In some countries no ox or cow would be thought good of its kind that was not red or brown without spots; in others a certain portion of white is essential. This is owing to the common colour of the breeds most esteemed in each country. The reason of the prejudice is the association of the colour with some defect, and those who breed for profit by sale must be ruled by the taste of their customers. The rational mode of proceeding is to be well acquainted with the anatomy of the kind of animal which we make the subject of our attention; to learn by experience what are the peculiar qualities of the different breeds, distinguished by any particular feature, and whether these qualities have any apparent connexion with the peculiarity in make or colour. We may then be guided by the knowledge thus acquired in our choice of individuals to perpetuate the breed, and not only preserve the useful qualities which they already possess, but gradually improve them. No greater mistake can be committed than that of making what are called violent crosses, such as coupling a very spirited male with a sluggish female, an animal with large bones with one of very slender make, a long-limbed animal with a compact one. By such crosses the first produce has often appeared much improved; but nature is not to be forced, and if the breed is continued, innumerable deformities and defects are certain to follow. The safe way is, to choose the animals as nearly alike in their general qualities as possible, taking care that where there is a defect in one it exist not in the other, which would infallibly perpetuate it. A defect can never be remedied by means of another of an opposite kind, but, by great attention, it may be diminished gradually, and at last disappear entirely. This refers, however, to *defects*, not to peculiar qualities. Cows, for example, may produce either milk or fat in abundance from similar food; and a breed of cow which secretes too much fat, so as to be deficient in the milk necessary to rear the calf, may be improved by selecting such as give more milk, and by crossing the breed with these; but we must be careful not to choose individuals which differ much in shape from the breed to be improved. Every attempt to unite opposite qualities is generally attended with a bad result. If a breed has too great an aptitude to fatten, so as to endanger the fecundity of the mother or the health of the offspring, the only remedy is to diminish the oily nature of the food; and if, on the other hand, a difficulty is found in fattening cows which are of a peculiarly good breed for the dairy, the loss on the old cow sold half fat will have been amply repaid by the milk she has given; and the bull-calves which are not wanted to rear for bulls, if they are not profitable to fatten as oxen, must be fatted off young and sold for veal. But it is not a necessary consequence of an abundant produce of milk that the cow, when dry, will not fatten readily, although a great propensity to fatten renders the breed less fit for the dairy. The Ayrshire, which are good milkers, fatten well when dry, and the oxen of that breed are as kind feeders as any.

Many breeders have an idea that coupling animals which are nearly allied in blood produces a weak race; others consider it as a prejudice, and among those who held the latter opinion was the famous breeder Bakewell. Without deciding this point, we should recommend avoiding too near a relationship, provided individuals equally perfect can be found of the same breed more distantly related. Every individual has some peculiar defect, and his descendants have a tendency to this defect. If two immediate descendants are coupled, this defect will probably be confirmed; whereas by uniting the descendants of different individuals the defect of either of the parents may never break out; but sooner than retrograde by coupling an inferior animal with one in an improved state, we should not hesitate to risk the consequences supposed to arise from what is called breeding in and in, that is, coupling animals nearly related in blood, especially if only on one side, such as the produce of the same male by different females, or of a female by different sires.

The qualities which distinguish animals in which the muscles and bones are required to be much exercised, as dogs, horses, and working oxen, are very different from those of animals destined to accumulate mere tender flesh and fat for human food. In the former there must be spirit, activity, and quick digestion; in the latter, indolence and proneness to sleep are advantageous. In the first, the lungs must play with ease, and the muscles be strong, and not encumbered with fat. In the second, the lungs must be sound, as they are essential to all the secretions, and the digestive power must be good, but slow. The food must not be accelerated through the bowels by exercise, but the absorbent vessels of the intestines must draw all the nourishment from the digested food. The more the muscles are impeded with fat, the better the animal will repay the food given him. To choose an animal to breed from whose produce shall get fat readily, we must attend to this part of the constitution, and care little about spirit and activity. The tendency to secrete bone, and those parts which are called offal by the butchers, as being of inferior value, is a defect. Good flesh and fat are the great objects.

The manner in which the more solid parts of the body are formed, and the greater consumption of food, in proportion to the increase of weight which takes place in young animals, while bones and horns are growing, prove that it is much more expensive to produce bone than flesh, and muscular fibre than fat. Hence it is evident that the greater profit is in fattening animals that have finished their growth ; and also that there is a superiority in those breeds which have small bones and no horns. This is an important point to be attended to by a breeder, as is also the time when the bony secretion is completed. A breed of animals that will cease to grow, or have attained their full size of bone at an early age, will be much more profitable to the grazier than one of slower growth. It is in this respect chiefly that certain breeds of sheep and cattle are so far superior to others. The principles which apply to cattle are equally applicable, *mutatis mutandis*, to sheep. In no case are strong bones or horns of much importance to the sheep in its domestic state. The principal objects are wool and flesh, which appear to be dependant on distinct and, perhaps, incompatible qualities. The attempt to unite the two is perhaps the reason why the Spanish breed, which has been improved when transported into Saxony, has degenerated in England, so that even its crosses are not in repute. It is a matter of mere calculation, whether sheep kept for their wool chiefly are more profitable than those which give an increase of meat at the expense of the quality of the wool. A breeder of sheep who attends only to the quality of the wool will not have his attention taken off from the main object by any deficiency in the carcass, or the disposition of the animal to increase in flesh and fat. It is possible that mixed breeds may be more profitable than the pure. Fine wool may not repay the breeder and rearer of sheep so well as moderate wool and good meat. But the principle we contend for is that of producing the most perfect animal of any one variety existing, by correcting individual defects gradually, and avoiding fanciful crosses, which may destroy in one generation all the advantages obtained in a great many. Hence it is a matter of great importance to consider well the qualities of the individuals with which you begin your improvement, and to know that these qualities have existed in their progenitors, and are not merely accidental. If crossing appear necessary, let it be done very gradually and cautiously. No experienced breeder would ever expect to improve the fleece of a sheep of the Leicester breed or the carcass of the Merino by a direct cross between these two breeds. The offspring would most probably lose all the good qualities for which each breed is noted, and produce a mongrel breed worth little in comparison. But a cross of Merinoes with South Downs, or Leicester with Costwold, might produce new and useful breeds, and these, carefully selected, as has been done, have produced mixed breeds, which by great attention may become very valuable.

When it is determined what breed of animals you wish to perpetuate and improve, the individuals which are to be the parents of the stock cannot be too carefully selected. The more nearly they are alike in form, colour, and exterior appearance, the more likely they are to produce a distinct race. They should neither be above nor under the usual size. They should be of such an age as to have entirely ceased growing, and be arrived at perfect maturity ; and, whatever may be their good qualities, they should not be selected, if they are the produce of very aged parents, at least on the female side.

In horses and horned cattle many breeders prefer a male rather less in size than the female, and pretend that the fœtus has more room to develop its members in what they term a *roomy* female. There may be some truth in this, but equality of size, or rather the due proportion established in nature, seems most likely to produce a wellformed offspring. Any considerable deviation from this is generally attended with defect. Nothing is more common than for a country gentleman who has a useful, favourite mare, not particularly well bred, when any accident has rendered her unfit for work, to have her covered by some very high-bred stallion, expecting to have a very superior foal. Sometimes this succeeds, but in general it ends in disappointment, especially if the mare be small. A much more certain way is to choose a half-bred stallion, nearly of the size of the mare, and having those good points which the mare already possesses. In this case there is every probability of rearing a well-proportioned and useful animal, instead of a *cross-made* one, as the breeders call them, probably from the very circumstance of these *crosses* not succeeding in general. We advert to this as a fact which many of our readers may know from experience.

To give in a few words the rules which result from what we have very briefly stated:

Choose the kind of animal which you wish to breed from, having distinguishing qualities; keep these constantly in view, and reject all individuals in which they are not as perfect at least as in the parents. Select the most perfect forms, and let the defects be corrected gradually. Have patience and perseverance, and avoid all attempts at any sudden alteration by bold crosses. If possible, breed two or more families of the same kind, keeping them distinct, and only occasionally crossing the one with the other. In this manner a very improved breed may be produced. The nearer you approach to perfection, the more difficult will be the selection, and the greater the danger of retrograding. Hence in very highly bred stocks it is often almost impossible to keep up the perfection of the breed, and a fluctuation in the quality of the produce will take place. The more improved the breed is, therefore, the greater attention must be paid in the selection of those which are to continue it. And for want of this, almost every breed, however reputed it may have been at one time, gradually degenerates, and loses its great superiority.

As every farmer and occupier of land is more or less a breeder, if he be only a breeder of pigs, these observations may be useful. In the articles on each particular species of animal, these general principles are applied, and more particular directions are given.

BREEDING IN AND IN. This is very injurious ultimately both in animals and man.

BREEDING PONDS. Ponds for raising young fish; they should have shallows with reeds and sedges. Pike and pickerel are in the habit of devouring the spawn when they can reach it.

BREEZE FLIES. The bot flies, *Æstridæ*.

BREWING. The making of beer. This consists of the following operations: 1st. The malt, properly ground or crushed, is put into a large tub with a false bottom, perforated by numerous holes, and furnished with a faucet. Over the malt, water, heated from 170° to 185°, is poured, and the whole well stirred or mashed together for some time. It is then allowed to settle, and the infusion drawn off into another tub. If two varieties of beer, ale and small beer, be desired, this first portion is kept separate, otherwise it is mixed with the second infusion. The second mash-water should be nearly 200° Fahrenheit. Four bushels of malt are treated to one and a half barrel, or fifty-one gallons of water, each mashing. The second infusion, after standing to settle, is also drawn off, and the two together form the sweet wort.

2d. The worts, mixed or separate, and even mixed with a third infusion, are next transferred to the boiler, and hops added. The amount of hops depends partly on the taste and partly on the strength of the beer; for common beer four pounds to the four bushels will answer. For the strongest ales as much as twenty-eight pounds are used. This mixture is boiled an hour and a half or more, until the fluid begins to assume a bright colour.

3d. It is then drawn off into coolers, or at once into the fermenting tuns. When cooled to about 60° Fahrenheit, two pounds of fresh yeast are added to every thirty-four gallons of wort, and the tun kept at the same temperature. As soon as fermentation is fairly established, and its first violence somewhat subsided, the liquor is transferred to suitable casks, the bunghole of which is left open as long as yeast is cast up, and afterward securely fastened. As soon as the beer or alcoholic fermentation ceases, vinegar begins to form, and the whole sours.

A wort may be prepared from any sweet juice or germinated seed, and, treated in the same way, will make beer. The strength of ales depends on the large quantity of sugar in the wort. Porters are coloured by brown malt, molasses, &c. Numerous bitters, many very injurious, as *Cocculus Indicus*, are used instead of hops.

BRICKS. Blocks of burned clay eight inches long, four wide, by two and a half deep. Larger moulds are made for particular purposes. Buildings have been recently erected of unburned bricks, which appear to be cheap, substantial, and durable when protected on the outside by cement or mortar. The following account of the method employed in Geneva, New-York, gives all the necessary details:

The materials are two parts clay, one sand, with straw and water, as in ordinary brick-making. It is well trodden or worked by oxen until sticky. With the materials for one thousand bricks three hundred pounds of straw are mixed. The bricks are moulded with an ordinary wooden frame, of the size intended for the wall, so as to form it one brick deep. For a building thirty feet in height, bricks eighteen inches square, and six deep; for lower cottages, twelve inches square will answer. The mould is dipped in water, sanded, and then filled with clay, and struck with a piece of wood. The fresh-made brick should be sanded if the day be hot. They are set flat on the dry ground on boards, and towards night the sets are covered with boards. The next day they are set on end, with spaces between the bricks, and after four days of fine weather they are piled up with air spaces, and covered with boards. In a fortnight they are ready for use.

The foundations are set in stone or burned bricks, two feet above the earth, and the first course of blocks put down in water-lime. Interior partitions are put up with bricks of the ordinary size. Windows and doors should not be fixed permanently at once, but left until the building is well set. Fixtures to the wall are fastened into timbers introduced during the building. Fire-places must be of burned brick. The roof must project sufficiently to keep water from running into the materials.

A coating of water-lime or cement completes the building, which is said to be warm and perfectly free from dampness, and very much cheaper than wood. "A house in Geneva, New-York, twenty-one by twenty-seven feet, and two stories high, cost less, when completed, than four hundred dollars." For a fuller account, see the *Home Missionary* for September, 1844.

BRICK EARTH. Any stiff clay, containing fifty to seventy per cent. of real clay, and the rest sand: the latter of these answers also for tiles. It is either blue or red.

BRIDLE. A contrivance made of straps or thongs of leather, and pieces of iron, in order to keep a horse in subjection, and direct him in travelling. The several parts of a bridle are the bit or snaffle; the head-stall, or leather from the top of the head to the rings of the bit; the fillet, over the forehead and under the fore-top; the throat-band, which buckles from the head-band under the throat; the nose-bands, going through the loops at the back of the head-stall, and buckled under the cheeks; the reins, or long thongs of leather that come from the rings of the bit, and which, being cast over the horse's head, the rider holds in his hands.

BRIMSTONE. Roll sulphur, made by melting and casting common sulphur. See *Sulphur*.

BRINING GRAIN. Grain and the seeds of grasses, &c., are often prepared, before sowing, by being introduced into a strong brine, which may be heated to 150° Fahrenheit, or even higher. The brine is made by adding common coarse or refuse salt to water until it is strong enough to float an egg. The brined seed is afterward dusted with newly-slacked lime, and sown. The great benefit is the destruction of the seeds of smut, rust, mildew, and other blights: when heat is added, the eggs of many insects are also killed. Stale urine is also used with great effect in the same way, as well as strong wood-ash lye. The plan of brining is extensively resorted to throughout England and Scotland with great success; indeed, so beneficial does small doses of salt appear, that on the seashore, and on farms where refuse salt is used, smut is almost unknown. A solution of one pound of salt to one gallon of water is recommended as a wash or sprinkling for plants infested by mildew and other fungi by the late Mr. Cartwright. It is, however, injurious to some vegetables. Brining has been often found to save a field from rust and smut when all other grain was infested.

BRISTLES. The stiff hair of hogs. Independently of their economical value, they constitute a manure as good as old woollen rags, containing, indeed, the same substances, and yielding ammonia by decay. Where they can be had in sufficient quantities, one half to three fourths of a ton is a heavy manuring for five years for hops, turnips, cabbages, tobacco, hemp, flax, wheat, corn, and rich plants generally. The same applies to all kinds of waste hair or wool.

BRITISH GUM. Starch heated to 600° Fahrenheit, by which it becomes brown and soluble in cold water.

BRITTLE HOOF. An affection of the horse's hoof, very common, especially in summer, in England, from bad stable management. A mixture of one part of oil of tar and two of common fish oil, well rubbed into the crust and the hoof, will restore the natural pliancy and toughness of the horn, and very much contribute to the quickness of its growth.—(*Youatt on the Horse.*)

BRIZA. The generic name of the quaking grass (*B. media*). It is a poor perennial grass.

BROAD-CAST SOWING. The distribution of seed or manures over land by casting with the hand or by a machine. The sower carries a basket on the left arm, and throws with his right hand as he walkes along between the lands or ridges of the field, sowing one half its width in going, and the other half in returning on the other side. Small seeds are usually cast with some earth. It requires experience and good ploughing to seed well, for unless the ridges between each furrow are well marked, so as to present grooves to receive seed, they will not grow in rows; but when the furrows are nicely laid the plants appear as regularly as if drilled. Of late it has been customary to disparage sowing by broad-cast, in consequence of the waste of seed, the tendency to weeds in the ground, and the difficulty of exterminating them. To avoid these evils, drills are introduced. The broad-cast method is certainly altogether inapplicable to turnips or any other crop requiring hoeing, or liable to destruction from weeds, and is now seldom practised in such cases; but wheat, grains, grasses, fallow crops, &c., are thus sown most readily and very effectively. Machines for broad-casting are of little utility where the farmer has a little experience.

BROCCOLI. An improved variety of cabbage, the flower buds of which are eaten. It differs from the cauliflower only in the looseness of the inflorescence. The varieties are numerous, the early white and white cape being best; but the purple cape is the only kind much cultivated. The seeds of the last are sown towards the end of May in the Middle States, and later in the South; for winter supplies later sowing will be necessary. An ounce of seed produces 3000 to 4000 plants. Transplant in July, or when the plants are large enough, into very rich, dunged, and mellow earth; plant 18 to 24 inches apart each way; moisten the earth frequently with fluid manure; hoe and keep clean during their growth. They will be in season in September and October. For winter kinds, it will be necessary to take plants up as soon as slight frosts appear, lay them in light soil, and place them in frames, to ripen during winter and early spring. In the Southern States the winters are mild enough to allow of their growth abroad.

BROKEN KNEES. See *Horse, Diseases of.*

BROKEN WIND. Prof. Youatt attributes this incurable nuisance in horses to stuffing them with too much coarse provender, and working soon after meals. Horses are granivorous, and should rest at least one hour after food, be fed three times daily, and not once or twice.

BROMINE. An elementary brown fluid, of a *vile odour* (βρωμος), extracted from salt-water and sea-weeds. It is very similar to chlorine in its properties; hitherto used only by Daguerrian artists. Its scarcity makes it very expensive.

BROMUS. A genus of grasses, of which *B. secalinus*, common cheat. or chess, is most famous. Many species exist in America, but they are not of value in permanent meadows.

BRONCHIA. (βρογχος, *the throat.*) The ramifications of the windpipe in the lungs.

BRONCHITIS. Inflammation of the bronchia. See *Horse, Diseases of.*

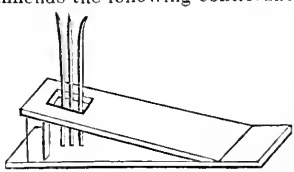
BRONCHOTOMY. The operation of opening the trachea low down.

BROOD-MARES. Mares should not breed till three years old. When taken care of they bear twenty years. They heat in spring, and carry young about eleven months. May is the best month for covering.

BROOM. The European shrub *Spartium scoparium*, which bears bright-yellow papilionaceous flowers, and is hence cultivated in shrubberies. It is used also as a cover for game and shelter to young plantations. *S. junceum*, Spanish broom, is prettier, and fragrant. *S. monospermum* bears white flowers. These are common, except the last, throughout the United States.

BROOM-CORN. The *Sorghum saccharatum*. Another plant, the *S. dora*, is the Indian millet. The cultivation of broom-corn for the manufacture of brooms and for seed is of great profit in the Valley of the Connecticut, Mohawk, and in New-Jersey. It would be still more profitable in the South, as in these localities the frost sometimes hurts the plants before the seed ripens.

The best variety is the New-Jersey, which yields upward of 1000 lbs. of broom, and much seed, per acre. The North River yields 720 lbs. The pine-tree variety is earliest, but small and thin. The seed crop averages from 50 to 80 bushels. The best alluvial soils are chosen, and well manured. The seed is planted in May, at the rate of a tea-spoonful to the hill, the hills being three feet by eighteen inches apart, so as to allow the cultivator to run between the rows. The hills are dunged with old compost immediately before sowing. It is hoed or worked three times, like corn. Seven to ten plants are left in the hill; the thinning takes place at the first hoeing. The crop is harvested at the first frost. The stems are bent, or partly broken 2½ feet from the ground, and left to dry for a few days; the stalks are next cut, at six or eight inches from the brush. The produce is next dried in the barn on scaffolds, or in any convenient way. The best broom is cut when of a yellowish green. The seed is removed by pulling the panicles or brooms through a scraper, which tears them off. Mr. Allen, of Massachusetts, who has had much experience in this matter, recommends the following contrivance:



The lower board rests on the barn floor; the upper is moveable by a hinge, and can be set at any height; it is intended to grasp the three upright rods, B; the central is of stout iron, the side ones of elastic steel. The panicles are forced down between these rods, and then pulled towards A; thus the seed is torn off, and slides down the upper board into the barn.

The seeds are worth twenty-five to thirty cents the bushel, and are considered equal to oats. The broom sells at from four to six cents the pound. It is a very profitable crop, and will remain so, from the large exportations of brooms. The large quantity of seed it produces constitutes it a very exhausting crop.

BROOM GRASS, or STRAW. The genus *Andropogon*, so called from the little tufts of hair or beards on their flowers. They are not introduced into culture, and have little economical value.

BROWN DYES. The commonest are the decoctions of oak bark, common bastard marjoram, walnut peels, horse-chestnut peels, and catechu. Oak bark and walnut (English walnut is best) give dyes without mordants, but are brightened by alum. Catechu (1 lb.) combined with blue vitriol (4 oz.) gives a bronze when used in a boiling solution. The tints of brown are, however, so numerous, that it is more common to use madder as a basis for the red tints, fustic for the yellows, and use solution of iron and copper as mordants, and even a gall-nut bath afterward, to reach the proper shade.

BROWSE. The young branches of trees, shrubs, &c. (*v.*) To feed.

BRUCHUS. A Linnæan genus of coleopterous insects, of the tribe *Rhyncophora*, now the type of a family (*Bruchidæ*), with the following characters: upper lip distinct; head produced anteriorly into a broad, flattened snout; palpi filiform; antennæ filiform or serrate; eyes notched; wing-sheaths not covering the extremity of the body. The insects of this family deposite their eggs in the young grains or seeds of leguminous plants; the time of the hatching of the eggs is when the seeds have approached to maturity, and then the larvæ begin to feed voraciously upon them. One species, the *Bruchus granarius*, infests our pease; and the ravages of this insect and the *Bruchus pisi* have been so extensive as to call for legislative interference.

BRUCIA. A vegetable alkaloid, similar to strychnine, and poisonous.

BRUMALIS. (*Bruma, winter.*) Appertaining to winter.

BRYONY. *Bryonia dioica.* A climbing herb, of a poisonous nature.

BUCK. The male of deer, rabbits, &c.

BUCK-BEAN. *Menyanthes trifoliata.* A swamp plant, with handsome flowers and bitter leaves. The latter are used as a substitute for hops, and are a mild tonic.

BUCK-EYE. Two western trees bear this name, the *Pavia lutea* and *Ohioensis;* they belong to the same family as the horse-chestnut. They are wholly ornamental, the wood being of no value as timber.

BUCK-THORN. The *Rhamnus catharticus.* A prickly shrub, suitable for hedges. It is indigenous in New-York, and easily cultivated by seeds, slips, or suckers. The berries are cathartic and griping. The *R. infectorius*, a similar shrub, produces the famous French or Persian yellow berries used in dyeing. It might be readily cultivated south of Maryland, as it grows in Provence.

BUCKWHEAT. The grain produced by the *Polygonum fagopyrum* (*a*), *tartaricum* (*b*), and a few other species. In the United States the first only is cultivated; but it is said a new wild Italian species yields more abundantly. The seeds are small, dark, and angular. From twenty to thirty bushels are obtained from the common kind per acre. Buckwheat is usually sown on rocky places or poor soils, of a silicious or calcareous nature; but it grows well nearly anywhere. It may be sown in May for a full crop; or immediately after wheat, rye, or oats, for a fall crop; or still later, to be fallowed in the fall. From 1 to $1\frac{1}{2}$ bushels are necessary to the acre. It soon starts in a dry, warm soil; flowers in July or earlier, and continues producing flowers for some time. As it is a native of Persia, the least frost is injurious; it


a b

should therefore be cut early in October, or at the end of September. As the seeds scatter, some recommend pulling by the roots; but a cradle-scythe answers every purpose. In consequence of the succulence of the stems, it requires to be sweated in cock when dried for fodder, and should be threshed as early as convenient. The stalk, well cured, is a good rough fodder, and forms a valuable addition to the cattle-yard. M. Antoine has shown, on the most authentic data, that it is very superior to common straw, and of half the value of prime hay.

As a fallow crop, it is very valuable, from the size (2 feet) it attains on poor sands, and the ease with which it ferments and yields food to the next crop. The flowers are sought by bees, but form a dark, rather harsh honey. It is also cut in flower for soiling milch cows, and is very good mixed with clover, but too much is apt to produce drowsiness. Poultry and all cattle eat the seeds or meal. It is rather superior to oats, as the following composition shows:

Woody fibre	25
Starch	50
Albumen, &c.	14·5
Oil	0·4
Salts	1·5
Water	16·0
	100

Its ashes sometimes contain an excess of potash salts, sometimes of lime, these being isomorphous.

The seeds are ground into meal for making buckwheat cakes, which are highly relished throughout the country. In Germany malt is made with them, and beer and spirits. Birds, especially pheasants, are very fond of them. The Maine farmer recommends the cultivation of buckwheat to destroy couch grass; the first crop is to be ploughed in when flowering, and another seeded upon it at once; from the last, grain may be collected.

Some species of polygonum yield good yellow dyes, as the *Siberian*; others, as the *bistorta*, are acrid and poisonous.

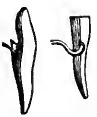
BUD. The growing point of a branch, consisting of young unexpanded leaflets or flower petals. Winter buds contain a small store of starch and albumen at their base to sustain the leaflets in spring. *Flower buds* are usually developed on spurs or in the axils of leaves, while *leaf buds* are seen on the vigorous shoots. All buds are in contact with the inner bark of trees, and with the young wood, from which latter they derive sap for development. *Adventitious* or *latent buds* are such as break out from the bark of trees without having any external sign or eye; they are, however, marked on willows by roughnesses on the bark, in other trees by knaurs. In all that respects structure and function, the eyes of potatoes, dahlias, the bulbs of tulips, onions, and all seeds are perfect buds, these different parts being modifications of the same general plan.

The development of lower buds in trees or branches is readily effected by cutting away the upper, which, as they are more excitable, usually take the first start, and, using all the sap, hinder the growth of the lower eyes.

BUDDING. The insertion or *inoculation* of the buds of one tree into the branches or stock of another. The buds are to be taken from the year's shoot about midway, and from a healthy, full-bearing tree. The time is from July to September, as soon as buds are well formed. The incision into the stock is through the bark down to the new wood and in the form of a T; this can be made with any knife, but the following is called a budding knife:

The bark must be raised at the angles, and should separate readily from the wood. The bud is cut along with about half an inch of bark (*a*), and slightly into the wood, so that the part immediately below the eye may be so furnished, and not hollow. The wood removed is only to ensure the heart of the bud, and as little as possible is left in the insertion. The part above the eye is then cut straight (*b*), and the bud introduced between the lips of the wound on the stock, down to the new wood, and pushed in firmly, the upper cut part corresponding very nicely with the horizontal incision. A bass riband, a strip from the shuck of corn, or any other bandage that does not hold water, is then cast round the stock two or three times above the bud, and gradually brought round so as to bind the insertion tightly, except over the eye. The riband must be loosened in two or three weeks if the bud swells, so as to give room for growth. *Spring* budding is also practised, the winter's bud of a tree being inserted at the time of sap rise; the only difference in this case is, that the incision is inverted thus ⊥, and care is to be taken that the bud has been cut a few days, so as to be rather behind the vegetation of the stock.

a *b*



The stock or branch after budding is to be lopped down by a clean transverse cut at about three buds above the insertion, all the lower buds being removed. In spring, or when the insertion starts, it is to have full room, and as it gathers strength, the upper natural shoots from the buds left are to be pruned, and finally cut altogether away towards midsummer, if the insertion has taken well.

Budding is practised to secure choice varieties of fruits, to mix ornamental kinds on the same tree, and to improve shrubbery. But the process is seldom successful unless the stock and variety are of the same species or nearly allied. The only difficulty in the way is the entrance of rain water into the wound of the stock; to hinder this effectively, it is well to add a little cement of tallow and wax over the incision, or to use bass dipped in such a mixture while warm.

In the dahlia, orange, and some other trees cultivated for dwarfs, the bud is inserted on a piece of the root instead of a stock; this is, however, termed grafting, as it is introduced in the cleft fashion.

BUFFALO. The American buffalo or bison (*Bos Americanus*), once inhabiting the central portions of the United States, are now driven beyond the Mississippi. They are found in immense flocks, and are very timid and retired, except in the rutting season, when the bulls become fierce and pugnacious. The animal is remarkable for a hump on the back between the shoulders, for a long mane, broad chest, and great strength of head and neck. The buffalo breeds readily with domestic oxen, but the young of the bull buffalo is too large for the pelvis of the common cow; hence the mixture can only be made by crossing the wild cow by the domestic ox. Captain Jenkins, of Missouri, has several half-breeds of this kind, which promise to be capital draught animals, large, heavy, hardy, and easily sustained.

The skin is handsome, black, and glossy, and a considerable article of trade. The hide, tanned, is said to be softer, thicker, and less pervious to water than the ox hide.

BUFFALO BERRIES. The fruit of the *Shephardia* (or *Hippophæ*) *argentea*, silver-leafed shephardia. A handsome, thorny, small tree of Missouri. It is diæcious, the fruit scarlet, of the size of currants, in profuse clusters. It is said to be rich in flavour, and excellent for pies and preserves.

BUFFALO GRASS. A Western indigenous grass of small size, forming a delicate mat, and growing on dry, gravelly soils. The *gama* grass is sometimes called by this name.

BUG. A common word, meaning any insect, but properly applied only to the bedbug (*Cimex lectularius*), which is the type of an extensive family of filthy insects which accumulate from neglect of cleanliness and laziness. Solutions of corrosive sublimate in water, ointments with the same poison, and fumigations with tobacco are used with success in destroying these insects. Boiling water poured into the crevices of beds, and repeated every week during spring, is very efficacious.

BUHR-STONE. The mill-stone for flouring; it possesses great hardness with little brittleness, is cellular, of a bluish gray, and feebly translucent. The best kind has a texture nearly half cellular, and is entirely silicious; the pieces or panes of rock are bound together by hoops of iron when set up for use. The great and valuable supply of buhr-stone is from near Paris in the lacustrine deposite, above the gypsum. It is the latest rock formation known.

Buhr-stone has been discovered in Georgia, near the South Carolina boundary, about forty miles from the sea. It lies above shell limestone.

BULB (from βολβος). A rounded body, having the properties of a bud, usually growing in the ground, but sometimes produced by the flower stalk. Bulbs are *tunicated*, as the onion, and *squamous* or scaly, like the lily. Many bulbs, when cut down through the centre, and planted in pieces, produce several plants. Onions are cultivated in this way in Russia. The adjectives *bulbous*, *bulbosus*, are formed from bulb. The fleshy, solid root-stock of orchis is not a bulb, but *cormus*.

BULBODIUM. An underground stem resembling the root-stock.

BULL. The excellence of the bull should be well considered in breeding.

BULLACE. A wild plum of a light colour.

BURDOCK. *Arctium lappa*, and *bordana*. Troublesome, long-rooted weeds, difficult to eradicate. Their medicinal qualities are imaginary.

BURNED CLAY. See *Clay*.

BURNED EAR. The disease produced in grain by the *Uredo carbo*. It resembles smut, but does not attack the interior of the seed. It is most common on heavily-dunged lands in moist situations. *Brining*, especially in a brine containing a little blue vitriol, is efficacious in destroying its effects on grain.

BURNET SALAD. *Poterium sanguisorba*. It grows on the poorest calcareous soils, and is perennial. It may be propagated by cuttings or seeds. The leaves taste and smell like cucumbers; hence its use in salads. It is relished by sheep.

BURNS. A lotion of clear lime-water and linseed oil applied with a rag, and cautiously guarding from exposure to air, dust, or to injury, by a bandage, is the best treatment.

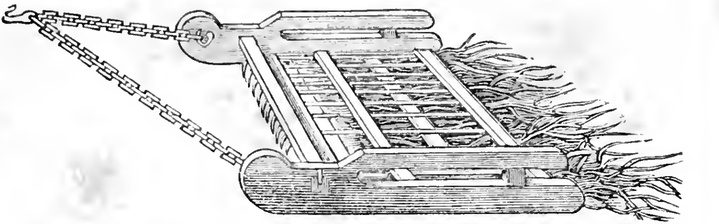
BURSA MUCOSA. Small bags containing a fatty mucus, situated be tween the joints in all animals.

BUSH. Any shrub which naturally throws out branches near or under ground. Wild bushes are destroyed by grubbing, by cutting down during summer, or by tearing up with oxen. July is the best month for cutting them down.

BUSH DRAINING. Placing bushes in the water-way of drains: the tops should be against the current. It answers well enough for twelve or more years, but is not so permanent as other means.

BUSH HARROWING. Drawing a bush attached to a chain over broken lands or seeded fields; or, when a weight is used, and thorny branches, it is sometimes employed to scarify meadows and prune the grass roots. An old gate may be used as a frame, or the more substantial contrivance figured on the next page.

BUSHEL. A measure containing 4 pecks, 8 gallons, or 32 quarts. It should contain 80 pounds of water, or 2218·192 cubic inches of capacity, to constitute an imperial bushel. The



old Winchester bushel contained only 2150·42 cubic inches.

BUSTARD. *Otis tarda.* A large gallinaceous fowl indigenous to Europe and Asia, often weighing twenty-five to twenty-seven pounds, and of delicious flavour. It has not yet been domesticated.

BUTTER. The preparation of butter is an important part of rural economy. Butter is the fat or oleaginous part of the milk of various animals, principally of the domestic cow. The milk of the cow is composed of three distinct ingredients: the curd, the whey, and the butter; the two first form the largest portion, and the last the most valuable. The comparative value of the milk of different cows, or of the same cows fed on different pastures, is estimated chiefly by the quantity of butter contained in it; and in this respect some breeds of cows are far superior to others. The union of the component parts of milk is chiefly mechanical, as they separate by subsidence according to their specific gravities, the cream being the lightest, and the curd the heaviest; the curd, however, requires a slight chemical change for its separation from the whey, which, at the same time, produces a peculiar acid, called the lactic acid. From the moment that milk is drawn from the cow it begins to be affected by the air and changes of temperature, and circumstances almost imperceptible to our senses will materially affect its quality; hence the importance of extreme care and attention in every step of the process of the dairy, especially in making butter.

The cows should be milked in the cool of the morning and evening; they should not be much driven immediately before milking, and it is best to bring them to the place of milking some time before the operation begins. In some situations it is better to milk them in the pastures, and carry the milk home; in others, to drive the cows gently to the cowstall. In mountainous countries the first mode is generally adopted, because the cows are apt to leap down steep places, and shake the milk in their udder more than is done by carrying it in the pail.

As the slightest acidity or putrescence immediately causes an internal chemical action in milk, it is of the greatest importance that the place where the cows are milked, and the persons employed, should be of the greatest purity and cleanliness. The milking house should be paved with stone or brick, and no litter or dung be permitted to remain in it. It should be washed out twice a day, immediately before each milking, which, besides ensuring cleanliness, produces a refreshing coolness highly useful to the milk. The teats of the cows should be washed clean with water and a sponge. The vessels into which the milk is drawn from the cow should be made of very clean wood; they should be scalded immediately after having been used, and then exposed to the air, so as to be perfectly dry by the next time of using them. Tin vessels are preferable to wood, because they are not so easily tainted, and are more easily kept clean. Where these are used they should always be kept bright, by which means the least speck of dirt is immediately discovered.

The milk, as soon as it is brought

into the dairy, is strained through a fine sieve or cloth, in order to remove any extraneous matter, and it is then poured into shallow pans or troughs. The best pans are of iron, carefully tinned. Such pans are cool in summer, and in winter allow of the application of heat, which is often very useful to make the cream rise. When leaden troughs are used, they are generally fixed to the wall, and have a slight inclination towards one end, where there is a hole with a plug in it, by drawing which the thin milk is allowed to run off slowly, leaving the cream behind, which runs last through the hole into the pan placed under to receive it. The milk in the pans, or troughs, is generally four or five inches in depth, which is found most conducive to the separation of the cream. The place where the milk is set should have a thorough draught of air, by means of opposite windows. The sun should be carefully excluded by high buildings or trees, and the floor, which should always be of brick or stone, should be continually kept moist in summer, that the evaporation may produce an equal, cool temperature. A small stove in winter is a great advantage, provided smoke and smell be most carefully avoided, and the temperature be accurately regulated by a thermometer. All these minutiæ may appear superfluous to those who have no practical knowledge of the dairy; and many dairymen, who cannot deny the truth of what we have stated, may excuse their deviation from these rules by saying that good butter is made without so much care and trouble. This may be true; but they cannot ensure good butter at all times; and when cleanliness and order are brought to a regular system the trouble disappears.

When the milk has stood twelve hours, the finest parts of the cream have risen to the surface, and if they are then taken off by a skimming dish, and immediately churned, a very delicate butter is obtained; but, in general, it is left twenty-four hours, when the cream is collected by skimming, or the thin milk let off by taking out the plug in the trough. All the cream is put into a deep earthen jar. Stone-ware is the best. More cream is added every day, till there is a sufficient quantity to churn, which, in moderate dairies, is every two days. It is usual to stir the cream often, to encourage a slight acidity, by which the process of churning is accelerated. This acidity is sometimes produced by the addition of vinegar or lemon juice; but, however this may facilitate the conversion of the cream into butter, we would not recommend it, as the quality is decidedly injured by it, especially butter which is to be salted. It has been asserted by some authors that butter will not separate from the butter-milk until acidity is produced, and no doubt there is more or less of lactic acid in all butter-milk; but perfectly fresh cream, which has stood only one night, and is churned early next morning, will generally produce excellent butter in a quarter of an hour or twenty minutes in summer, and no acid taste can be discovered in the butter-milk. That the state of the atmosphere with respect to temperature has a powerful influence on the making of butter, is a well-established fact.

The common method employed to separate the butter from the thinner portion of the cream is by strong agitation. The common instrument is the *churn*, which is a wooden cask rather wider at bottom than at the top, covered with a round lid with a hole in the centre. Through this hole passes a round stick, about four feet long, inserted in the centre of a round, flat board with holes in it; the diameter of this board is a little less than that of the top of the churn. Various improvements have been made on this machine. The cream should not fill above two thirds of the churn. By means of this stick, held in both hands, and moved up and down, the cream is violently agitated, passing through the holes in the board and round its edge every time the stick is raised or depressed, and thus every portion is brought into contact with the air. In the course of an hour's churning, more or less according to circumstances, small kernels of butter appear, which are soon united by the pressure of the board against the bottom of the churn, and form a mass of solid butter. The butter is collected with the hand, and placed in a shallow tub for the next operation. The butter-milk is set aside for the pigs, or for domestic use. The butter is still mixed with some portion of butter-milk; but much of its quality for keeping depends on the perfect separation. The most usual way is to spread it thin in a shallow tub, beating it with a flat wooden spoon, and washing it repeatedly with clear spring water until all milkiness disappears in the water which is poured off. Some experienced dairymen pretend that the butter is deteriorated by much washing, and, therefore, express the butter-milk by simply beating the butter with the hand, kept cool by frequently dipping it in cold water, or with a moist cloth wrapped in the form of a ball, which soaks up all the butter-milk, and leaves the butter quite dry. This operation requires the greatest attention, especially in warm weather; and no person should work the butter who has not a very cool hand. The less it is handled the better, and therefore a wooden spoon or spatula is much to be preferred. The presence of any curd renders butter liable to putrefaction, and is, to a great extent, the cause of the unpleasant taste of that made carelessly in summer.

The greatest portion of the butter that is made, especially at a distance from large towns, is immediately salted and put into casks, which usually contain fifty-six pounds, and are called firkins. The quality of the salt used is of great importance; if it be pure, the butter will keep its flavour for a long time; but when it is impure, and contains bitter and deliquescent salts, the butter soon becomes rancid. The Dutch are very particular in this point. They use a kind of salt which is made by slow evaporation, and perfectly crystallized. The salt is intimately mixed with the butter. From three to five pounds are sufficient for a firkin of fifty-six pounds. The following mixture has been found superior to salt alone in curing butter: half an ounce of dry salt, pounded fine, two drachms of sugar, and two drachms of saltpetre, for every pound of butter. It is used in Goshen, Orange county, New-York. The casks are made of clean white wood. They are carefully washed inside with strong brine made hot, and rubbed over with salt. The butter, being quite dry, is pressed close into the cask, a small layer of salt having been first put on the bottom. Every addition is carefully incorporated with the preceding portion. If there is not a sufficient quantity to fill the cask at once, the surface is made smooth, some salt is put over it, and a cloth is pressed close upon it to exclude the air. When the remainder is added at the next churning, the cloth is taken off, and the salt which had been put on the surface carefully removed with a spoon. The surface is dug into with a small wooden spade, and laid rough, and the newly-salted butter is added and incorporated completely. This prevents a streak which would otherwise appear at the place where the two portions are joined. When the cask is full, some salt is put over it, and the head is put in. If the butter is well freed from all the butter-milk, and the salt mixed with it quite dry, it will not shrink in the cask, and it will keep its flavour for a long time. Should there be an appearance of shrinking, the cask must be opened and melted butter poured round it, so as to fill up the interstices between the butter and the cask; in this way it will not suffer in its quality. There is a mode of preserving butter for domestic use without salt, in the following manner: the butter is set in a clean pan over the fire and melted very gently; it is not allowed to boil, but is heated very nearly to the boiling point. Experience has shown this heat to be attained when the reflection of the white of the eye is distinctly seen on the surface of the butter on looking down into the pan. All the watery particles are then evaporated, and the curd, of which a portion always remains in the butter, and which is one cause of its becoming rancid, falls to the bottom. The clear butter is poured into an earthen vessel and covered over with paper, and a bladder or a piece of leather is tied over the jar to exclude the air. When it is cooled it much resembles hog's lard. It has lost some of its flavour, but it is much superior to salt butter for culinary purposes, and especially for pastry.

The Devonshire method of making butter differs materially from the common process which we have described, and is peculiar to that county. The milk, instead of being set for the cream to rise, is placed in tin or earthen pans holding about eleven or twelve quarts each. Twelve hours after milking, these pans are placed on a broad iron plate, heated by a small furnace. The milk is not allowed to boil, but a thick scum rises to the surface. As soon as small bubbles begin to appear where a portion of this is removed with a spoon, the milk is taken off and allowed to cool. The thick part is taken off the surface, and this is called *clouted cream*. It is a sweet, pleasant substance, more solid than cream, but not so solid as butter, and is considered as a dainty by all those who have been early accustomed to it. A very slight agitation converts it into real butter, after which it is treated exactly as we have before described. It does not keep well. It does not appear that there is any peculiar advantage in the Devonshire method.

Another method of making butter, which is more generally adopted, is to churn the milk and cream together. In the Dutch method the milk is put into deep jars in a cool place, each *meal*, or portion milked at one time, being kept separate. As soon as there is a slight appearance of acidity, the whole is churned in an upright churn, which, from the quantity of milk, is of very large dimensions. The plunger is therefore worked by machinery moved by a horse, or sometimes by a dog walking in a wheel, which he turns by his weight. When the butter begins to form into small kernels, the contents of the churn are emptied on a sieve, which lets the butter-milk pass through. The butter is then formed into a mass, as described before. This, from Professor Trail's experiments, is the most economical method, as the quantity of butter is great and the butter-milk rich.

In Scotland the following method is pursued: the milk is allowed to cool for six hours, and then put into a clean vat. As long as it remains sweet, more milk may be added, but not after any acidity is produced. It is then covered and allowed to get sour, till it coagulates at the top; this coagulum is called the *lapper*, which must not be broken till the butter is churned. When the clotted milk is put into the churn, warm water is added so as to raise the temperature to 70° or 80°, the whole being gradually stirred in. When this is properly conducted, the butter-milk will be very pleasant and wholesome, with a sub-acid taste, the whey and curd not being separated from each other for some time after. The butter is said to be fully equal to that made from cream alone.—(*Quarterly Journal of Agriculture*, Dec., 1834.)

The quality of the butter depends on some very minute circumstances, which escape the notice of all superficial observers. The smallest particle of putrescent matter accidentally added, and even mere effluvia, give a turn to the chemical action going on from the moment the milk is exposed to the air, and they taint the cream more or less. The quantity of pure cream which rises when the milk is set in the pans, as well as its quality, is influenced by these circumstances. When the milk curdles before the cream is separated, it is almost impossible to prevent some portion of the curd being mixed with the butter. In its perfectly fresh state the taste is not affected by this; but the butter will not keep fresh above twenty-four hours, and when salted soon becomes rancid. Thus a greater quantity is produced, but of inferior quality. When cheese is made of the milk from which the cream has been taken, it will be found most profitable not to attempt to take off all the cream by repeated skimming; for more will be gained in the better quality of the cheese than by an increase in the quantity of the butter at the expense of the quality.

It is an acknowledged fact that, such are the niceties of the dairy, great experience alone can ensure a produce of superior quality, and this experience would be more readily acquired if the circumstances were accurately observed and noted. We would recommend to those who have extensive dairies to mark by the thermometer the temperature of the milk and cream in the different stages of the process, occasionally to test the acidity of the butter-milk by means of alkalies, and to note any peculiarity in the atmosphere by an electrometer. A few observations carefully noted, repeated, and compared would throw more light on the true causes which favour or oppose the production of good butter than all the guesses that have hitherto been made.

The quality of the butter depends materially on the nature of the pasture. The best is made from cows fed in rich, natural meadows. Certain plants which grow in poor and marshy soils give a disagreeable taste to the butter. When cows are fed with cut grass in the stable, the butter is inferior, except in the case of some artificial grasses, such as lucerne. Turnips and other roots given to cows in winter communicate more or less of a bad taste to butter, which is corrected in some degree by means of a small quantity of water and saltpetre added to the milk; and also, it is said, by giving salt to the cows with their food. But there is no butter made in winter equal to that which is made where the cows are fed entirely with good meadow hay, especially of the second crop, called after-math hay, which contains few seed stalks.

According to the accounts of the produce of butter from different countries and various breeds of cows, we may state that, on an average, four gallons of milk produce sixteen ounces of butter; and to make the feeding of cows for the dairy a profitable employment, a good cow should produce six pounds of butter per week in summer, and half that quantity in winter, allowing from six weeks to two months for her being dry before calving; that is, one hundred and twenty pounds in twenty weeks after calving, and eighty pounds in the remainder of the time till she goes dry; in all, about two hundred pounds in the year. If she produces more, she may be considered as a superior cow; if less, she is below par. To produce this quantity the pasture must be good, and we must allow three acres to keep a cow in grass and hay for a year, which is not very far from the mark.

An inferior kind of butter is made in some cheese dairies from the oily portion of the milk skimmed from the whey, which is set in pans, like milk, after the cheese has been made. It is totally unfit for salting and keeping. It is known by the name of *whey butter*.—(*W. C. Rham.*)

BUTTERFLY. Insects of the genus *Papilio* (Lin.) in the imago state. Many of them are produced from the caterpillars most injurious to cultivated plants and trees, as the gooseberry and cabbage butterflies.

BUTTERNUT. A tree of the walnut genus, *Juglans cinerea.* It is diffused throughout the United States. The wood is of a reddish colour, light, soft, but very durable, and not liable to attacks from insects. It is highly esteemed for turnings in the Eastern States, and is abundantly used for panelling for carriages, and building generally. The inner bark is cathartic, and a decoction is used by housewives.

BUTTERS, VEGETABLE. The solid oils of the cocoa, nutmeg, palm, chocolate, &c., are so called.

BUTTON-WOOD. *False sycamore.* The *Platanus occidentalis*, western plane-tree, the largest, and one of the handsomest trees of America. It reaches its full dimensions only in the rich alluvion of the middle Western States, on the banks of the Ohio. The wood is soft, and decays rapidly when exposed, but is serviceable for sheltered carpentry. The tree in the Northern States has been much injured by early frosts and insects.

BUTTS. The short ridges which are made by the plough in the corners of irregular fields.

BUTYRIC ACID. An oily volatile acid found in rancid butter, and having a rancid smell; it is soluble in water, alcohol, and ether: boils at 212°. It consists of $C_8 H_{5\frac{1}{2}} O_3 HO$ (ch). It is formed by the oxidation of the component of butter called butyrine, and yields by distillation from lime butryone, a neutral volatile liquid.

BUXUS. The generic name of the box plants. See *Box-tree*.

BYRE. A cow-shed for feeding, &c.

BYSLINS. The first milk of the cow after calving.

BYSSUS. A general name for the thread-like mould of cellars and caverns of vegetable origin. They belong to many genera, and to the family of fungi.

C.

CABBAGE. The varieties of cabbage, coleworts, broccoli, are all derived, by cultivation, from the *Brassica oleracea*, a sea-shore plant, indigenous to Europe. It belongs to the cruciferous famliy of Jussieu, and *Tetradynamia siliquosa* of Linnæus.

In agriculture, they may be divided into three classes: 1st. Those that form heads. 2d. Those that grow erect without forming heads. 3d. Those that are napiform, as *Kohl rabe*.

Of Cabbages which form Heads.—These may be divided into early, midsummer, and autumn kinds. Of the first, the early dwarf, early York, early sugar-loaf, early imperial are the best. The midsummer kind are the large York, large sugar-loaf, Bergen, drumhead, flat Dutch, and the autumn, the late glazed red, and the varieties of Savoy. The seeds, in ordinary culture, are sown in April; but for early crops they are sown in September, and covered by a frame during winter; or in a frame in February, care being taken to supply light and air without admitting frost. An ounce of seed yields from 3000 to 4000 plants. In the garden, where a succession is required, seeds must be sown every two weeks from February to May. The seeds start in a week, and are fit to transplant in six or seven weeks. There is, however, no advantage in transplanting too soon, as the young plants are very liable to be destroyed by the cutworm and insects during June and early in July. They are set in rows 16 inches to 2 feet apart, allowing sufficient room for hoeing, ploughing, &c. The Bergen are set 30 inches apart. It is economical to place an extra plant between each, to be cut for collards. At this rate, the acre contains about 6000 plants. The soil must be very fine, and well dunged, for no vegetable is more improved by putrescent manures. In planting, it is necessary to use a trowel to open the ground, and not a stick to ram a hole. The process of dipping the roots in a semifluid mass of fine earth and water, with half a pound in four gallons of crude nitre, and of whale-oil soap, is highly recommended as ensuring a vigorous start for the plants, and being very serviceable in keeping off worms. A bucket with this mixture can be readily carried by the planter. The ground must be ploughed, hoed, or thoroughly stirred three times during their growth, weeds being destroyed, and the soil kept fine. During a dry season they require watering, and will be much benefited by the use of fluid manures. The soil they most relish is a moistish loam, made very rich with putrescent manures. Extensive fields of cabbages are cultivated near New-York city; the early kinds and large Bergen, Savoy, and red being most preferred.

The following is an estimate of the expense, by Mr. Wyckoff, for an acre: 40 loads street manure, $16; labour in distributing, $3; ploughing, harrowing, and hoeing, $9; or in all, $28. The field contained 6000 plants, and 3000 heads sold in market realized $60. As soon as frosts set in the cabbages must be put up for protection. This is done by burying them up to the head in a dry, warm situation, stripping off decayed or broken open leaves, and packing them closely together, taking care that they are free from moisture. A low shed is then to be formed over them with straw, pine brush, boards, &c., so as to keep out the sun and frost, at the same time that air circulates freely. In the depth of winter it may be necessary to place straw around the sides of the shed; or, the cabbages being cut, may be stored in a root cellar.

Nutritious Value.—Cabbages are seldom raised as food for stock in the United States, although it is common enough to throw to hogs, &c., the under leaves which have begun to decay. In Germany and France they are extensively used as fodders. Two general kinds are employed, the open-leaved and hearted: of the first kind, according to Antoine's tables, 541 pounds are equal to 410 of green clover, or 100 of grass hay; but the hearted cabbage, according to Boussingault, is much more valuable, 370 pounds being equal to 100 pounds of hay. The amount of food procured from some of the cow cabbages is immense, often amounting during the year to upward of 100,000 pounds of leaves the acre.

Specific Manures.—The cabbage family are especially improved by well-decayed manures and by gypsum, or particularly by solutions of crude nitre and Glauber salts, one pound in about four gallons of water, applied by a flowering-pot, when transplanted; and subsequently they will be found of the greatest utility.

Seeds.—To obtain fine seeds, put out some of the heads which have been kept through winter; as soon as the weather permits, thin down the flower-stems to a few at the sides. Take care to keep the varieties separate, or they become mixed and spoiled.

It should be remarked of the cabbage stems kept over till spring, that, if they be set out, numerous eyes will develop, which afford early greens, and may be kept bearing a long time by hindering them from seeding.

2d. Of the open-leaved Varieties.—The principal varieties cultivated in Europe are the tree, or thousand-headed; the cow cabbage, or Cæsarean cole; the Jersey cole; the Woburn kale, and Poitou cabbage. They are sown in autumn in beds, planted out from November to February, are ready for plucking in April, and continue to afford leaves for forage during the summer, the stems running up to six and more feet. They stand the winters of France, and might be grown in the Middle and Southern States. It may be very questionable—when the rich land necessary, and the labour of cultivation are considered—whether they will be ever grown in the United States.

3d. Of napiform Cabbages.—Several hybrid varieties between the turnip and cabbage have been produced; these either have a swollen root and cabbage head, as the *Kohl rabe*, or they produce a turnip-like head. They are little cultivated, and resemble turnips, but are much less infested by insects.

CABBAGE, DISEASES OF. *Clubbing* of the roots arises from worms, and is produced by growing them too long in one locality. See *Anbury*. *Cabbage lice* are the same as bean lice. See *Aphis*. They are destroyed by infusion of tobacco, lime dust, salt. *Worms* of various kinds infest the leaves; the leaves should be stripped off and burned, or soot, tobacco, lime, &c., used to destroy them. *Cutworms* are caught before sunrise, and should be destroyed, or the foregoing noxious substances should be worked in about the roots with a trowel. *Slugs* are to be similarly treated.

CABBAGE, PREPARED. *Saucr*

kraut. This is prepared in the following manner: the cabbages are sliced thin by hand, or by a machine. The bottom of a cask, of which the head has been taken out, is covered with salt, and a layer of thin-sliced cabbage, six inches thick, is laid over it; on this a quantity of salt is spread, and another layer of cabbage, mixed with some juniper berries and whole pepper; and thus salt and cabbage alternately until the cask is filled. A round board is then put into the cask, so as nearly to fill it, and on this a heavy weight of stone or metal is laid. As the cabbage ferments and sinks, the cask is filled up with fresh salt and cabbage. After some time the expressed juice is poured off, some water, with salt dissolved in it, is poured over, and changed until it ceases to rise with a scum and fetid smell; the cabbage is then in a fit state to be kept. A cloth is laid over it, and over this the round board and weights. When any portion is taken out for use, a sufficient quantity of brine is allowed to remain over the mass to exclude the air, and the cloth, board, and weights are replaced as long as any cabbage remains. This *sauer kraut*, when washed with soft water, and stewed with bacon or salted meat, is a very wholesome dish, and much relished by those who have been early accustomed to it. In long voyages it has been found to be an admirable preservative against the sea-scurvy.

CABBAGE TREES or PALMS. Palm-trees which, like the palmetto, form edible buds, which are used as food.

CACHECTIC. A bad state of body, bringing about boils, skin diseases, &c.

CACHMERE GOAT. The Cachmere goat is a native of Persia. There are many varieties, differing in colour and in the quality of the fleece; the principal points of the most approved breeds are large ears, limbs slender, and, above all, the wool or hair being straight, silky, and white.

They have been successfully introduced into France by M. Terneaux, and also into England by C. T. Tower, of Essex, who purchased four, two males and two females, of M. Terneaux, of Paris. The soil on which they were kept in England was moist, and the situation much exposed; they have, nevertheless, continued in health and multiplied rapidly, his flock increasing from four to twenty-seven in six years; the females producing every year a kid, and sometimes twins. They breed very early, often bearing young before they are twelve months old. They show no impatience of the cold, and are very healthy, requiring only an occasional shelter in very rough weather. In spring, summer, and autumn they graze like sheep, and during winter are fed with hay and refuse vegetables. The shawls made in England from the produce of Mr. Tower's goats will, for fineness of texture, vie with those brought from Persia. There is no doubt that it may be successfully introduced into this country. Being remarkably tame, they can be kept in flocks at as little expense and trouble as the common goat or sheep; they eat almost everything, even potato tops, weeds, and bushes of all kinds, taking but little from the pastures that other animals would feed on. We hope some of our enterprising farmers will turn their attention to this animal by importing it, as it can be easily obtained, and, no doubt, will bear the transportation and change of climate with very little risk.

CACTUS. A tribe of fleshy plants, some of which are celebrated for their splendid flowers and pleasant acid fruit resembling the gooseberry.

CADUCOUS. Deciduous, falling off, temporary.

CÆSAREAN OPERATION. The removal of a fœtus from its mother by cutting into the womb.

CAFFEIN. A slightly bitter, white, silky principle obtained from coffee, tea, guarana, and paullinia. It is the same as *theine*. Liebig finds it to consist of $C_8 H_5 N_2 O + HO$. He has shown that it may act as food in increasing the amount of bile formed, by furnishing nitrogen thereto. To the same end *asparagine* and *theobromine*, analogous principles, are also destined.

CALAMINE. A powdery mineral, sold by druggists as an absorbent for ulcerous sores and extensive burns. It is an impure carbonate of zinc, prepared by roasting. An ointment made with lard is sometimes used to promote the healing of sores.

CALANDRA. The genus of wheat weevils. See *Wheat*.

CALCARATE (from *calcar*, a spur). Flowers having a spur like the larkspur are so called. The spur is also called a *nectarium* by Linnæus.

CALCAREOUS. Containing carbonate of lime, as calcareous marl, soils, sand, &c. See *Lime*.

CALCINATION. The burning of substances to ashes.

CALCIUM. The metallic base of lime, which is an oxide of calcium. Its equivalent is 20, and therefore lime is 28. A few electro-negative bodies, as sulphur, chlorine, fluorine, form salts directly with the metal, and are called sulphuret, chloride, fluoride of calcium. See *Lime*.

CALC SPAR. Crystallized carbonate of lime.

CALCULUS. Any solid, stony concretion formed in the bladder, gall-duct, &c.

CALEFACIENT. Medicines that produce the sensation of warmth, as alcohol, are so called.

CALENDAR. A monthly record.

CALF. The young of the cow. Calves dropped in March and April are best for raising. If they are to be kept, they should run with the cow, in a meadow, for three to six weeks, and afterward be fed on butter-milk with meal, and separated into a good meadow. Those which are to be slaughtered are generally removed from the cow at once, put up into a small enclosure and feeding stall, and supplied with milk and messes of meal until fat. The males are castrated at thirty days for steers; the operation is very simple, one incision being made on each side the bag.

CALF, DISEASES OF. These are principally:

1. *Navel Ill.*—The best treatment for this dangerous disease is, 1st, to administer two or three doses (each about a wine-glassful) of castor oil; and, 2dly, cordials, which may be made of two drachms of caraway seeds, two of coriander seeds, and two of powdered gentian; bruise the seeds, and simmer them in beer or gruel for a quarter of an hour: give these once or twice a day.

2. *Constipation of the Bowels.*—For this, doses of castor oil, of two or three ounces, are the best remedy.

3. *Diarrhœa*, or *Scouring.* — The farmer may *rely* on the following mixture. Let him keep it always by him, it will do for all sucking animals:

Prepared chalk . .	4 ounces.
Canella bark, powdered	1 "
Laudanum	1 "
Water	1 pint.

Give two or three table-spoonfuls, according to the size of the animal, two or three times a day.

4. *Hoose*, or *Catarrh.*—Good nursing, bleeding, and then a dose of Epsom salts, with half an ounce of ginger in it.—(*Youatt on Cattle.*)

CALKERS, or CALKINS. The parts of a horseshoe turned downward.

CALLUS. When the bone of an animal is broken by accident, nature restores the union by depositing a quantity of bony matter around the loose extremities, and thus fixing them. This deposite is called a callus; it is absorbed after the limb is re-established.

CALOMEL. The sub-chloride of mercury. An admirable medicine, producing an increased secretion of bile and purgation. In bilious attacks, a dose of ten grains is one of the best medicines. It is a component of many cattle medicines (see *Ball*), in the dose of one drachm for a horse.

CALORIC. This name is given to the cause of heat, which is unknown. *Calorific*, capable of producing heat, as the calorific rays of the sun, which are found in the red and orange parts of the spectrum formed by flint glass.

CALVING. The act of bringing forth a calf. The cow should not be disturbed, and have comfortable quarters. A warm drink is usually given afterward, containing meal. She should be kept quiet, and rather underfed for a few days.

CALX. An old term for any earthy body produced by burning.

CALYCANTHUS FLORIDUS. The Carolina allspice: a fragrant shrub, with moroon-coloured flowers.

CALYX (from καλυξ, *a cup*). The outer green case of flowers. It protects the internal parts. It is coloured in plants like tulips, hyacinths, &c.

CAMBIUM. A gummy fluid formed in spring in our forest-trees. It affords the materials out of which the new wood and bark are partly made, and disappears in a short time.

CAMELLIA. A genus of evergreen shrubs, of which the *C. japonica* produces beautiful flowers, now diversified by cultivation. It requires a green-house for successful growth, but may be grown out of doors, near a south wall, covered with glass and matted during severe weather. It is propagated by cuttings, layers, and grafts. Flowers from January to March in the house. The *C. oleifera* is much cultivated by the Chinese for its oil, obtained by pressing the seeds.

CAMOMILE. The *Anthemis nobilis* furnishes the drug of this name. It is exotic, but grows readily in the Middle States. The plant is perennial and hardy, yielding three or four crops of flowers, which are bitter and tonic. It grows on poor, dry lands; is propagated by seeds, root cuttings, and layers. An infusion is very nauseous to many insects.

CAMP. A mould in which to keep potatoes, roots, &c., during winter. See *Barrow*.

CAMPANULATE. Bell-shaped: applied to flowers of that figure, as the *Canterbury bell*.

CAMPHOR. A solid essential oil, consisting of C_{20}, $H_{14}+2$ HO. It is a nervous sedative, soothing pain. It is obtained in the crude state by distilling the twigs, roots, &c., of several plants, chiefly the *Laurus camphora* and *Dryobalanops camphora*, trees of tropical Asia. It is purified by sublimation in Europe and America. Michaux is disposed to believe that the *Laurus camphora*, a large evergreen, might flourish in Florida. Camphor is peculiarly disagreeable to the insects which infest cloth and woollen goods. The solution in alcohol is the commonest form of the medicine. A solution in oil is an admirable embrocation to painful sprains, rheumatisms, &c.

Camphor is found in numerous herbs, especially peppermint, rosemary, thyme, lavender, &c. The quantity is, however, too minute to yield a commercial supply.

CANADA THISTLE. *Carduus arvensis*. Its perennial roots render it a great nuisance. The introduction of two-hoed or worked crops, with much tillage, is the most effectual remedy. Large doses (thirty bushels) of salt, or a heavy liming (one hundred bushels), on a clean fallow is much reputed as a means of clearing lands of weeds and insects.

CANARY GRASS. *Phalaris Canariensis*. An annual grass, yielding the canary seeds for birds. The seeds are sown as soon as the frost is out of the ground: they require a good dry loam. In September the plants are fit to cut. The heads are exposed to the air in heaps for some time, to assist the thrashing. The yield is from twenty-five to forty bushels; the straw is poor and scanty.

CANCELLATE. Full of cells; as the ends of the long bones.

CANCER. A malignant tumour, at first hard and painful, afterward ulcerous, attacking glands chiefly. The only remedy is extirpation, which should be done as soon as its nature is discovered. Cancer of the eye is common in cattle.

CANDLE. The best mixture for dip and mould candles is equal parts of sheep and beef fat. Lard must be avoided.

CANDLEBERRY MYRTLE. *Myrica cerifera.* Abounds through the United States. The berries are boiled in water, and the wax rises to the top: it is excellent for candles. The labour is said not to be repaid by the profits of their collection.

CANIS. The generic name of the dog species. See *Dog.*

CANKER. A disease of the bark of old trees, or such as are in a bad situation. It is sometimes attended with an exudation of fluid, at others not. The bark gradually dies, falls off, and the wood becomes dry and dead. Judicious pruning, an application of resinous grafting cement to all wounds, and tillage about the roots, are necessary. Young trees planted in old, cankered orchards, are soon infected.

CANKER IN HORSES. The separation of the hoof from the fleshy parts of the leg, attended with a diseased growth. Pressure and caustics are necessary, with rest, for a cure.

CANKER-WORM. The caterpillars which infest and devour the buds of fruit-trees, especially those of the *Geometra brumata.* See *Apple Canker-worm.*

CANNABIS SATIVA. Hemp, which see.

CANTER. An artificial pace to which horses are broken. It is considered much less fatiguing than the trot.

CANTHARIDIS. The blistering fly, which see.

CAOUTCHOUC. Indian rubber.

CAPERS. A prickly shrub of southern France and Italy, the *Capparis spinosa.* The young buds are

daily stripped off and cast into strong vinegar slightly salted, to produce the commercial capers. They receive a greenish tint from the use of copper sieves in separating the different-sized pickled buds for sale. The plant would grow well south of Maryland. It is highly ornamental for green-houses.

CAPILLARY ATTRACTION. Some fluids rise in fine glass tubes much higher than their level. This elevation is said to be owing to capillary attraction. It occurs to greater extents as the tubes are finer, and is an affinity exerted by the sides of the glass upon the fluid. The cause has been shown to be electrical, and to depend upon the electrical conditions of the tube and fluid. If there be no affinity, the fluid sinks. The minute tubes of plants assist in drawing up the sap by this attraction.

CAPILLARY VESSELS (from *capillus, a hair*). The minute vessels which exist over every part of the bodies of animals and plants.

CAPITULUM. That species of inflorescence in which the flowers are grouped together into a head, as in clovers.

CAPON. A male bird that has been castrated: it is increased in size thereby.

CAPRIFICATION (from *caprificus, a wild fig*). The practice of pricking the green fig with a piece of stick touched with olive oil, to hasten the maturity. It is regularly observed in the culture of the Levant figs.

CAPROIC ACID. One of the rancid acids of butter, having the smell of goats. Capric acid is very similar.

CAPSICUM. The generic name of the *Red pepper*, which see.

CAPSULE. In botany, a dry, membranous seed-vessel, generally splitting spontaneously into several parts, or valves. In chemistry, a thin porcelain, Wedgewood ware or metallic basin for evaporating fluids.

CAPUT MORTUUM. An old term designating the dregs left in any chemical process.

CARAWAYS. The seeds of *Carum carui*. They should be free from dust, and strongly aromatic. Are used in confections and medicine. They are grateful to the stomach, and slightly stimulant. The seeds are sown in drills six inches apart, in April. The land must be good, rich loam. The plants must be weeded and hoed when young. They flower in June, and the seeds ripen in autumn. The roots are perennial, and yield well for three years. As much as twenty hundred weight of seed is taken from an acre in good tilth. They are an exhausting crop. Near London, coriander, caraways, and teazles are sometimes sown together, twelve pounds of each being used. The coriander is cut in July, the caraway in July next year, and the teazles in August.

CARBON. An elementary body, found pure in anthracite and the diamond, and nearly pure in lamp-black and charcoal. It combines readily with oxygen, and burns, forming carbonic acid when air is abundant. Its equivalent is 6. It forms about half of the dry substance of all animal and vegetable bodies, and hence the char--al they yield when heated in closed -ssels.

CARBONATES. Minerals or salts -ntaining carbonic acid. These are all readily known by the effervescence they produce when thrown into strong acids. The principal native carbonates are marble, limestone, and chalk, which are carbonates of lime.

CARBONIC ACID. The gas formed by burning charcoal in the open air. It is also given out from fermenting beer, &c., and putrefying bodies. It is colourless, heavy, incapable of sustaining combustion, suffocating, and soluble in water. It is formed of 1 atom of carbon (6) and 2 of oxygen (16), and unites with oxides in the proportion of 22. The air contains 4 to 6 parts in 10,000. Fertile soils containing vegetable matter give it off during its decay. It is one of the principle articles of vegetable food: from the carbonic acid they obtain the carbon of their wood, sugar, and other principles. Light decomposes it in plants, and a part of its oxygen is thrown out by the leaves.

The dissolved carbonic acid in rain and spring water is invaluable in the soil, serving to disintegrate hard rocks, and dissolve minerals necessary for plants. It is this gas that gives sprightliness to beer, soda water, and Champagne.

CARBONIC OXIDE. An inflammable gas consisting of 1 atom carbon and 1 oxygen.

CARBONIFEROUS. Relating to coal. Coal bearing.

CARBURETS. Compounds in which carbon is united with a metal or other body. Plumbago, cast iron, are carburets of iron.

CARBURETTED HYDROGEN. Marsh gas, and the gas used for lighting cities.

CARCINOMA. A cancerous tumour.

CARDAMOMS. The seeds of the *Alpinia cardamomum* of the East Indies. They are aromatic.

CARDIAC (from *καρδια, the heart*). Relating to the heart.

CARDOON. The *Cynara cardunculus*. The stalks of the blanched inner leaves are used as salad, in soups, &c. The seed is sown in April, in rich earth; it requires nearly a month to start; the plants must be thinned to five inches apart. Transplant in June, and allow four feet each way; dress each plant like celery. As they grow, tie up the leaves, and earth up several times; they may thus be obtained two feet high. They are to be taken up during winter, like celery. They are in perfection from autumn through the winter. An ounce of seed produces 600 young plants; for seeds protect the plant, without any blanching, through the winter, and it will flower in the following July.

CARDUUS. The generic name of numerous thistles.

CAREX. The genus of sedges and rushes.

CARIES. Mortification or ulceration of any bone. It gradually produces the destruction of the part, and can only be arrested by scraping out every diseased portion.

CARMINATIVE. Any medicine that dispels flatulency and relieves the uneasiness of the stomach. The best are caraways, ginger, anise seed, cardamoms, especially as tinctures, or dissolved in alcohol.

CARNIVORA. The race of animals that live on animal food.

CAROB. A tree cultivated in Southern France for the pods it produces. These contain a reddish pulp of a sweet, amylaceous nature, and are a foot long. They are used as food for men and horses.

CAROTID ARTERY. The large arteries that carry red blood to the head. There is one on each side the neck, known by its strong pulsations.

CARPEL (from καρπος, *fruit*). Each division or cell of a fruit is a carpel. The number of carpels, or carpellary leaves, is as the number of divisions in the pistil, which is the uppermost part of the carpel.

CARROT. The *Daucus carota* improved by tillage, of the natural family *Umbelliferæ*. The carrot requires a deep, dry, sandy loam, which should be prepared by subsoiling; they are also much improved by humus in the soil, and come best after a crop to which a heavy manuring has been given. The best field kinds are the white, the long red, the Altringham, and the orange; of these the white is most prolific and valuable. The amount of seed is three to five pounds the acre; it must be steeped well, or kept in moist mould until it has germinated, and sown in drills one inch deep and one foot apart. For a full crop, April is the time of planting; but a fair yield can be obtained by sowing immediately after wheat, or in June. The plants must be well worked, weeded, and thinned out to five inches; but it is erroneous to pull the leaves for fodder. In October, or when the ground is beginning to freeze, they can be raised by turning the earth from the roots by a plough, and drawing them by hand. They are to be topped, and stored in the cellar, or a proper barrow or camp; they will keep well till spring. A good crop is 600 bushels; but 400 is more common. There is no peculiarity in garden culture, except that the early orange must be sown sooner; the long orange is the best fall crop.

Expense of Cultivation.—Colonel Meacham, who succeeded in obtaining 1000 bushels of carrots per acre for several years, estimates the expense per acre at $35. This culture adapts the land admirably for wheat or barley.

Value as Food.—It is extensively used in England, and to some extent in the Eastern and Northern States, as horse fodder, and is well adapted to oxen, hogs, &c. The carrots should be boiled or steamed, or, if given raw, sliced with a vegetable cutter. According to Antoine's tables, 276 pounds equal 100 of hay (see *Fodders*); they make twice as good fodder as turnips, and nearly equal to potatoes. Carrots and hay are a good fodder for horses, or, when given alone, about fifty pounds prepared will be necessary each day. They are very fattening.

Special Manures.—The ashes of the carrot are, per cent., potash and soda, 45; lime, 10; sulphuric acid, 2·7; phosphoric acid, 5·14. It is, therefore, remarkable for its affinity for alkalies. Hence, ashes, common salt, and gypsum are eminently useful as manures. An abundance of well-rotted leaves and muck should be added.

Seeds.—These are procured by setting out fine roots in the spring.

CART. The one-horse two-wheeled carriage of husbandmen. They are considered superior to the wagon by Scotch farmers. A *cart load* is generally about thirty to thirty-five bushels of manure. Mr. Rham remarks: "For agricultural purposes, various kinds of carts have been invented. The capacious tumbril for carting earth and dung, with broad wheels to prevent their sinking in soft ground, is too generally known to require description. The best constructed carts have iron axles with the ends or arms turned smooth, and very slightly conical. The boxes in the naves of the wheels, which receive the arms, are made of cast iron, and ground smooth, so as to require only a small quantity of grease or oil to make the wheels run easily, without allowing any play or side motion. It is usual to give the axle a bend at the place where it enters the wheel, by which means the planes of the wheels are made to diverge from each other, and give more room for the body of the cart; but this is decidedly wrong. It is clearly proved that the draught is least when the arms are quite horizontal; and if the wheels are slightly dished, that is, if the spokes are driven into the nave obliquely, so as to throw the rim a little beyond the perpendicular, the lower part of the spokes in each wheel will slightly diverge, and give greater steadiness to the whole. When the axle is bent, the rim of a broad-wheeled cart must be slightly conical, in order that it may rest flat on the ground; and it is easily proved that in this case the load is dragged on the road at every revolution, along a space equal to the difference between the greater and lesser circumference of the rim of the wheel, giving unnecessary work to the horses, and greatly injuring the roads. The light Scotch cart, drawn by one horse, is justly considered as the most advantageous for transporting earth, lime, or dung, especially in hilly countries. It is low and short, so that the horse draws very near the centre of gravity, and there is little power lost by obliquity. The loads may be so adjusted as to bear more or less on the horse, according to the declivity; and experience has proved that more weight can be transported by a given number of horses, when each is attached to a single Scotch cart, than when three or four draw together, except it be on very level and hard roads, or when the horses move at a quick pace. The objection made to single-horse carts, that each requires a man to drive it, is obviated in Scotland, where the horses are trained to follow each other, and one man can attend to several carts and horses."

CARTHAMUS. See *Safflower*.

CARTILAGE. The same as gristle. It is almost identical in composition with skin, and yields, when perfectly dry, eighteen per cent. of nitrogen. Liebig regards it as protein, combined with ammonia.

CARYA. The generic name of the *Hickory*.

CARYOPHILLOUS. Flowers like the *pink* and *clove* are so called.

CASCARILLA BARK. A drug having tonic and aromatic qualities.

CASEOUS. Relating to caseum.

CASEUM. Pure curd of milk. It is also found in beans, pease, and leguminous plants, and in small quantity in most seeds. It differs from albumen and fibrin only in not being coagulated by heat, and containing more sulphur. Cheese is caseum, for the most part; like other *protein* bodies, it is capable of sustaining life. When moist, it decays and putrefies like animal matter, but is preserved when dry, or prepared with salt.

CASSAVA. The starch obtained from the roots of the *Jatropha manihot* of the West Indies. See *Tapioca*.

CASTANEA. The generic name of the chestnut-tree.

CASTOR-OIL PLANT. The *Ricinus communis*, commonly called *Palma Christi* from the leaves. In the East Indies it is a tree, but becomes an annual in the United States, and is cultivated as far north as New-Jersey, and abundantly in the West.

The seeds are sown in hills like corn, and hoed until they are two feet high. The time of sowing is in April and May: the ground must be rich. The seeds are enclosed in capsules at the summits, and are easily thrashed out. The crop is stated at twenty to twenty-five bushels the acre. The oil is separated in two different ways: 1st. By boiling the bruised seeds enclosed in a bag, and skimming off the oil as it rises, and, finally, pressing the bag. 2d. By heating the seeds in iron trays slightly, so as not to char, pressing under a screw, collecting the oil, and boiling in water, taking care to separate all the white parts, and reserving the pure limpid oil only. This is placed in barrels. The seeds yield about one fourth of their weight of good oil. The price fluctuates considerably.

CASTOR OIL. An admirable purge for animals, especially calves: four to six ounces is enough for a strong ox. It is now used for burning and machinery, as well as for candles, when prepared by the separation of the fluid parts from the stearin.

CATALPA. The *Bignonia catalpa*, a middling-sized tree, nearly fifty feet high, growing in the Middle States and South, remarkable for its large flowers and leaves. The wood is durable, and makes good posts and fences, and is said, by Dr. G. B. Smith and others, to be more lasting than locust or mulberry. It grows very rapidly.

CATARACT. In farriery, a disease in the eyes of horses, in which the crystaline humour is rendered opaque, and the vision impeded or destroyed. The only certain method of cure in these complaints is to remove the lens by means of extracting or couching. By the first-mentioned operation, an incision is made into the eye through the white membrane, and the opaque lens taken out; by the second, it is depressed by the point of a couching needle thrust into the eye, and, being carried to the lower part of the chamber of the eye or vitreous humour, it is left there to be absorbed. The first operation is the more effective, but the more hazardous of the two, owing to the inflammation which succeeds. The second is tedious and sometimes fails, but it is less free from the risk of inflammation.

CATARRH. A cold. The irritation of the mucous membrane of the nostrils.

CATCH-DRAINS. The lower ditches of irrigated lands, which receive the water that has flowed over their surface, and return it to the stream.

CATECHU. A drug of a very astringent or binding nature. It is also used in dyeing browns and in tanning.

CATERPILLAR. The worm, or larva, which is hatched from the eggs of butterflies and moths. They are peculiarly obnoxious, from feeding on the leaves, fruit, and bark of trees. The most effective method of exterminating them is to keep the tree regularly cleaned by washing with lye, brine, soft soap, and removing every appearance of cocoon or network about the branches. The application of strong hartshorn to the caterpillar nests is practised by Mr. Pell with great success. Lime is also very hurtful to them. Caterpillars, after a season, depending on their species, either spin a cocoon and retire therein to change into a grub, or burrow into the earth or trees, and undergo a transformation therein. The grub changes in spring to a butterfly or moth, which lays some five hundred eggs, which in a few days become caterpillars: thus, in three generations, if untouched, thirty million worms are produced.

CATHARTICS. Medicines producing increased defecation. Aloes, castor oil, senna, jalap, Glauber salts, Epsom salts, calomel, are the principal cathartics. They should be used very sparingly, as they produce habitual costiveness after a time.

CATKIN. A pendulous spike of flowers, which falls after a season, as in the willow. *Amentum* is the more common designation.

CATSUP. Mushroom catsup is readily made by placing a bushel or more prime mushrooms in a tub with sufficient salt to cover them slightly, and adding water enough to cover the whole. The brine becomes black and well-flavoured in a week, when the mushrooms must be thoroughly pressed, and the whole liquor bottled and sealed. It is improper to add pepper or spices.

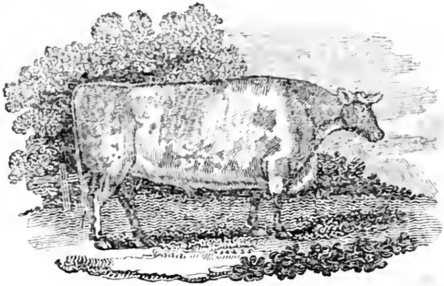
CATS-TAIL GRASS. An English name for timothy and other grasses of the genus *Pheum.*

CATTLE. In its most extensive sense, the word cattle denotes all the larger domestic quadrupeds which are used for draught or food. In the usual acceptation of the word, it is confined to the ox, or what are called black cattle, or horned cattle. But as many varieties are not black, and several have no horns, the name of *neat cattle* is more appropriate. The rearing and feeding of cattle are very important branches of agricultural industry. Much of the success of a farmer depends on the judicious management of live stock, without which his land cannot be maintained in a proper state of fertility. The breeding and fattening of cattle are generally distinct occupations. It is of the greatest importance to the breeder, as well as to the grazier, to ascertain the qualities of each different breed of cattle, to determine which is best suited to his purpose, and which will bring him the greatest profit.

The different British and Irish breeds have been generally distinguished from each other by the length of the horn. The long-horned breed is supposed by many to be indigenous. Others consider the middle horned as the old breed. The former was chiefly found in a district of Yorkshire called Craven, and was greatly improved by the skill of Robert Bakewell, of Dishley Farm, in Leicestershire, and hence they are called the Dishley breed. The distinguishing characters of this breed are, long horns growing downward from the side of the head, and ending in straight points parallel to the jaw. In order to give an adequate idea of the qualities of this improved breed, we must consider what breeders and graziers call the fine *points* of an ox. These are certain forms and appearances, which are either anatomically connected with a perfect conformation of the body, and especially of the organs of respiration and of digestion, or which are constantly associated with the peculiar qualities of certain breeds, so as to be proofs of their purity. Of the first kind are, a wide chest, well-formed barrel, strong and straight spine, hipbones well separated, and length of quarter, all which can be proved to be essential to the perfect functions of the body. Small and short bones in the legs give firmness without unnecessary weight. A thick skin, well covered with hair, ensures proper warmth, and its soft, loose feel indicates a good coat of cellular substance underneath, which will readily be filled with deposited fat. All these are indispensable points in an ox which is to be profitably fatted, and, whatever be the breed, they will always indicate superiority. Other points, such as colour, form of the horns, shape of the jaw, and setting on of the tail, with other particulars, are only essential in so far as experience has observed them in the best breeds, and as they are indications of pure blood. The eye is of great importance; it should be lively and mild, indicating a healthy circulation, with a gentle and almost indolent temper. An animal that is not easily disturbed will fatten rapidly, while one that is restless and impatient will never acquire flesh. Among the ancients, a deep dewlap was considered as a great beauty in an ox. In some of our best breeds there is scarcely any. The rump of the Freyburg cows rises high towards the tail, while a straight back, from the neck to the tail, is indispensable in a well-bred British ox.

Having established a breed which has many superior qualities, attention is paid to maintain its purity; and to those who cannot ascertain the parentage, certain marks are satisfactory proof of purity of blood. The new Leicester oxen were noted for the smallness of the bone and their apti-

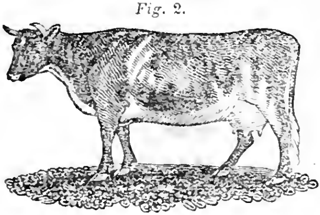
Fig. 1.



New Leicester.

tude to fatten (*Fig.* 1). Their flesh was fine-grained, the fat being well intermixed in the muscles. At the time when Bakewell died, about 1795, no other breed could be brought into competition with his improved long-horns. But whether his successors have not paid the same attention to keep up the qualities of the breed, or it has degenerated in comparison, they have since lost much of their reputation, and the short-horned breed has now the superiority. Good long-horned cattle are, however, occasionally seen in the midland counties. One defect of the breed was, that the cows gave but little milk; and this may be the reason for now preferring the short-horns. The Teeswater or Holderness breed of cattle (*Fig.* 2)

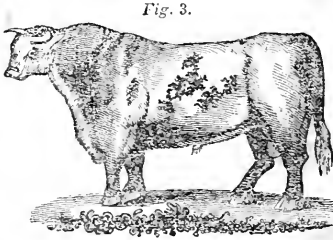
Fig. 2.



Holderness Cow.

was produced by the importation of cows from Holstein or Holland, and careful breeding and crossing. They now much excel the original stock. The principal improver of the Teeswater breed was Mr. Charles Collins. By his care a breed has been produced which is unrivalled for the dairy and for fattening readily. Almost every good breed now in existence traces its pedigree to his bulls, especially one of the first he used, called *Hubback.* The famous ox exhibited thirty years ago, under the name of the Durham ox, was of this breed. By careful crossing with a Galloway cow, an improved breed was produced, which was in such repute that, at a sale of Mr. Collins's stock of short-horns, October 11, 1810, a famous bull, called Comet, sold for 1000 guineas, and 48 lots of bulls, cows, and calves realized £7115 17*s.*—(*Library of Useful Knowledge*, "Cattle," page 233.) The short-horned cattle (*Fig.* 3)

Fig. 3.



Short-horn (Durham).

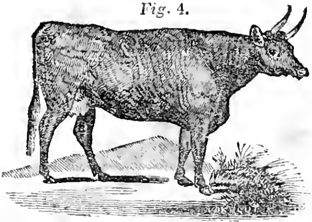
are mostly light coloured, some quite white, but most are speckled with red and white, without any large, distinct spots. The horns are very short. In the cow, the points turn inward towards each other. Some of the finest bulls have merely a tip of a horn standing out from each side of the forehead. In the carcass they have every point which we have before enumerated as essential to perfection.

From numerous importations of

Durhams, this breed is now diffused into many parts of the United States, especially New-York, Pennsylvania, and Kentucky.

Besides the two breeds above mentioned, there are several in great repute in particular districts, which almost dispute the superiority with the short-horns. Of these, the Devonshire breed is the handsomest. The colour of this breed is invariably red, with a very fine head, small bone, and glossy hide. The oxen, although not so heavy as some, are the best for the plough on light lands; they walk nearly as fast as horses, and will work almost as well in pairs. The cows (*Fig.* 4) are good milkers,

Fig. 4.



Devon Cow.

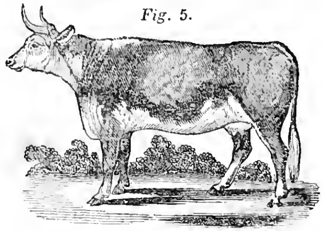
any deficiency in quantity being made up by the richness of the cream. The oxen fatten readily, and their flesh is of the best quality.

It is supposed that the fine oxen of New-England are derived from this breed.

The Sussex breed is only distinguished from the Devon by being rather stronger, and not so fine in the head and horn.

The Herefordshire breed is larger and heavier than either of the preceding, the horns longer, and more turned outward; the colour is red, but the belly and the face are generally white, and there is often a white stripe along the back. This breed has many excellent qualities, and fattens well; the cows (*Fig.* 5) are of use for

Fig. 5.

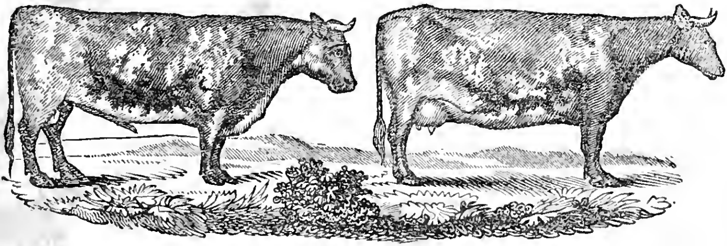


Hereford Cow.

the dairy, but yield only a small quantity of milk. The Herefordshire oxen are best suited to the rich pastures of their native county, where they grow to a great size, and increase fast. These are the principal English breeds.

The principal indigenous Scotch breeds are the West Highland, the Galloway, the Angus, and the Shetland. There is a doubt whether the Ayrshire (*Fig.* 6) should be classed

Fig. 6.



among the pure Scotch cattle. Their great resemblance to the short-horn in all but the size leads one to suppose that they are a cross of a smaller breed by a short-horn bull, but they have very good qualities, and are excellent for the dairy or for stalling.

A great many cattle are bred in the various islands which lie on the western coast of Scotland. They are mostly of a small, black breed, called Kyloes. They are very hardy, and, when brought into good pasture, fatten rapidly, and produce the finest and best-flavoured beef. They are found in the greatest perfection in the Isle of Skye, and are sent annually in large droves from their native islands, and dispersed through Scotland and England. If they do not produce so great a weight of beef as many other breeds, they always bring the highest price in the market, and require but a very short time to get fat. The Galloway is a peculiar breed, which has many good qualities: it has no horns; the body is compact, and the legs short; and few breeds can vie with the Galloway oxen and heifers in aptitude to fatten. There is a peculiar roundness in all the parts of the body, which makes the animal look well in flesh even when he is lean. The skin is loose, and the hair soft and silky to the touch. They are mostly black, but some are of a dun colour, which shows a connexion between this breed and the polled Suffolk; it is only the colour which distinguishes them. Many of the Galloway heifers are spayed, and get very fat at an early age. The Galloway cows are not very good milkers, in which respect they differ from the Suffolk, but their milk is very rich.

The *Angus doddie* is also a polled breed, and has been long in repute. It is probably a variety of the Galloway, to which it bears a strong resemblance, but it has been found in Angus from time immemorial.

These are the principal breeds of cattle in Britain. By selecting those which are best suited to each situation and pasture, the industrious farmer may add considerably to his profits, and, at the same time, enrich his land with the manure. In purchasing cattle, it is very necessary that the age should be readily ascertained: the surest mode of doing this is by examining the teeth. A calf has usually two front teeth when he is dropped, or they will appear a day or two after his birth; in a fortnight he will have four, in three weeks six, and at the end of a month eight. After this, these milk-teeth, as they are called, gradually wear, and fall out, and are replaced by the second and permanent teeth. At two years old the two middle teeth are replaced; the next year there will be four new teeth in all; at four years there are six permanent teeth, and at five the whole eight are replaced. The milk-teeth do not always fall out, but are sometimes pushed back by the second set; and in this case they should be removed with an instrument, as they impede mastication and irritate the mouth. After six years old the edges of the teeth begin to wear flat, and as they wear off the root of the tooth is pushed up in the socket, and the width of the teeth is diminished, leaving interstices between them: this begins in the middle teeth, and extends gradually to the corners. At ten years old the four middle teeth are considerably diminished, and the mark worn out of them. After fifteen years of age few cows can keep themselves in condition by pasturing, but they may continue to give milk, or be fattened by stalling and giving them ground food. Horned cattle have rings at the root of their horns, by which the age may also be known. The first ring appears at three years of age, and a new one is formed between it and the scull every year after. But this mode of ascertaining the age is not so sure as by the teeth, deception being much easier by filing off the rings.

In order to learn by experience what breed of cattle is most profitable, it is very advantageous to weigh them occasionally and note their increase. Experience has shown the proportion between the saleable quarters and the offal in different states of fatness, and tables have been constructed by which the nett weight is found by mere inspection. Multiplying the live weight by 0·605 gives a near approximation to the neat dead weight in an ox moderately fat and of a good breed. When an ox is fat, his weight may be very nearly guessed by measuring his girth immediately behind the fore legs, and the length from the tip of the shoulder to the perpendicular line which touches the hinder parts, or to a wall against which the animal is backed. The square of the girth in inches and decimals is multiplied by the length, and the product multiplied by the decimal ·238. This gives the weight of the four quarters in stones of fourteen pounds. This rule is founded on the supposition that there is a certain proportion between the nett weight of the quarters and that of a cylinder, the circumference of which is the girth, and the axis the length, taken as above. The proportion has been ascertained by observation and repeated comparison. The measurement will, at all events, indicate the proportional increase during the period of fattening.

Cattle are not subject to many diseases if they have plenty of food and good water, and are kept clean. Air is essential to them; and although cows will give more milk, and oxen will fatten better when kept in warm stalls in winter, they are both less subject to diseases when they are kept in open yards, with merely a shelter from the snow and rain.

The most economical mode of feeding cattle is evidently by allowing them to seek their food on commons and uncultivated pastures, but it is only in particular situations that it is the most advantageous. Cattle fed on commons add little to the stock of manure, except when they are kept in the yards or stalls in winter; even then their dung is of little value if they are merely kept alive on straw or coarse hay, as is generally the case where the stock is kept on commons or mountains in summer. When they feed in enclosed and rich pastures, their dung falling in heaps on the grass does more harm than good. The urine fertilizes the soil in wet weather when it is diluted, but in dry weather it only burns up the grass. If we calculate what would be the amount of dung collected if the cattle were kept in yards or stables, and fed with food cut for them and brought there, and also the loss of grass by treading on the pastures, we shall have no doubt whether the additional labour of cutting the grass and bringing it home daily is not amply repaid by the saving; but if we also take into account the variety of artificial grasses, pulse, and roots which may be grown with advantage on land unfit for permanent grass, and the quantity of arable land which may thus be kept in the highest state of cultivation, we shall be convinced that the practice of those countries where the cattle are constantly kept at home is well worthy of imitation. It may be of use to the health of the animals to be allowed to take a few hours' air and exercise in a pasture near the stable, but there is no advantage in their having any grass crop there; on the contrary, the barer of grass the surface is, the better. They will relish their food better when they are taken in after a few hours' fasting. A bite of fresh, short grass might, on the contrary, give them a dislike to their staler food. When cut grass is given to cattle in the stalls, it is best to let it lie in a heap for at least twelve hours before it is given to them. It heats slightly, and the peculiar odour of some of the plants, which oxen and cows are not fond of, being mixed with that of the more fragrant, the whole is eaten without waste. Experience has shown that many plants which cattle refuse in the field, where they have a choice, have nutritious qualities when eaten mixed with others in the form of hay. There are few deleterious plants in good grass land or meadows, and these are readily distinguished and weeded out.

The amount of hay, or its equivalent, necessary to sustain oxen is about two per cent. of their weight daily; when fattening, four per cent. is often given. The accumulation is seldom more than two and a half pounds daily in fattening.

The quantity and quality of the dung of cattle which are stalled and well fed are so remarkable, that its value makes a considerable deduction from that of the food given, especially of green food, such as clover, lucern, and every kind of leguminous plant: we shall not be far wrong if we set it at one fourth. This supposes a sufficient quantity of straw for litter, and an economical collection of the liquid parts in proper reservoirs or tanks. In order to make the feeding of cattle advantageous, the buildings must be conveniently placed with respect to the fields from which the food is to be brought. Moveable sheds, with temporary yards, which can be erected in different parts of a large farm, according as different fields are in grass or roots, are a great saving of carriage, both in the bringing of food to the cattle and carrying the dung on the land. A clay bottom should be selected, in a dry and rather high spot, if possible. But if permanent buildings for cattle, constructed of rough materials and thatched with straw, were erected in the centre of about forty acres of arable land, in different parts of a large farm, it would probably be a great saving in the end.

Good water is most essential to the health of cattle, and that which has been some time exposed to the air seems the best for them. When they are fatted in stalls on dry food, they should always have a trough of water within reach. A piece of rock-salt to lick, or some salt given with their food, is highly conducive to their health, and will restore their appetite when it begins to flag. Rubbing the hide with a wisp of straw or a strong brush, as is done to horses, may appear a useless labour, but it is well known that there is no better substitute for that exercise which is essential to health. Where labour is not regarded, as is always the case when the owner of the cattle attends upon them himself, the curry-comb and the brush are in regular use, and the advantage derived from the use of them is undeniable.

Where the farmer distils a spirit from his grain, it is a great advantage to have a distillery attached to his establishment, especially in a remote situation; and not only is the fattening of cattle on the refuse of the distillation a source of profit, but the manure extends fertility around. The produce in spirits and in cattle is easily transported to a great distance, and almost the whole of what is produced by the land returns to it in the shape of manure. The same may be said of the manufacture of sugar from beet-root, which has been lately so much extended in the north of France.

CATTLE, DISEASES OF. See *Ox.*

CATTLE, NATIVE. Much discussion exists as to the propriety of importing cattle from abroad, or undertaking an improvement of the native. The fine steers of New-England are said to be descended from the Devon stock, and retain many of their traits, while they are improved in milking qualities; but most of the other native stock is small, and inferior to the choice English breeds. But the size is probably due to the carelessness with which they are treated, and argues no inherent defect, in proof of which it may be stated that the New-York butchers prefer native animals for the shambles; and many instances may be quoted of cows yielding as much milk as even the Durham breed. The established foreign breeds are already brought up to a state of excellence, while our cattle are unimproved, and the occasional existence of fine animals is enough to guarantee high perfection when they shall be regularly bred. See *Breeding.*

Since, however, so many Durham bulls have been introduced into New-York, Pennsylvania, and Kentucky, it is very useful to obtain a cross with the native cow to increase the milking and fattening qualities, and also to advance in the process of improvement by using the best foreign blood; at the same time, a permanent and extensively diffused choice breed cannot be expected until our own stock are looked to in part at least: this is the proper way of securing a race suited to our climate and pasture. To attain this object, the prominent agricultural societies have offered prizes at their fairs for improved native stock.

CAUDATE (from *cauda*, a tail). Furnished with a tail-like appendage.

CAUDEX. The body of a root.

CAULIFLOWER. An improved cabbage, the flowers of which form a mass of great delicacy. The varieties cultivated in the United States are the *early white*, *late white*, and *purple*. Sow the seed in September in clean, rich soil, prick out in five weeks, and set in another bed four inches each way. As soon as the weather is cold, set a frame about the seedlings, and in winter protect with dung outside, &c., so as to keep out frost, but let in plenty of air and light. Early in March set out under hand frames, or in pots in the greenhouse. When the weather is settled, put out, with balls of earth attached, in the richest spot, two and a half feet each way. They must be hoed, earthed up, and watered, if necessary. Trim off the outer leaves as the cauliflower forms; they will be mature in June. This is the best way, but plants may be sown in hotbeds in February, or even in May, in the open air. They are, however, intolerant of cold and heat, and form small hearts during the summer. Those planted in May flower in October. An ounce of good seed yields from three to four thousand plants. Cauliflowers left for seed must be kept away from any other cabbage variety, and the seeds collected as rapidly as they ripen.

CAULIS (from καυλος). A stem. From this word comes cauliferous.

CAUSTIC. Any application that destroys the flesh or skin to which it is applied. The most powerful caustics are *lunar caustic* (nitrate of silver), *red precipitate* (nitrate of mercury), *caustic potash:* blue stone is also used. Sometimes a solution of blue stone or lunar caustic is applied to stimulate an ulcer or slowly remove excessive growth. Caustics are chiefly used to subdue irregular growths of flesh, and to destroy ulcers.

CAUSTIC, LUNAR. Nitrate of silver, sold in sticks, ready for use as a caustic; when used in solution, ten grains are mixed with an ounce of water.

CAUTERY, or ACTUAL CAUTERY. The application of a red-hot iron to a diseased part, as fungous growths, &c. It is too often used injudiciously.

CAVIARE. The salted roe of the sturgeon, prepared and dried. It is an unwholesome food used in Russia.

CEDAR. There are two species of *Cupressus* known in the forests of the United States under the names of black cedar, or cypress (*C. disticha*), and the white cedar (*C. thyoides*). They both yield good timber.

The *C. disticha* is abundant in the swamps of Virginia and the South, and forms the only tree in immense swamps on the Mississippi. In these localities it often rises 130 feet, and attains 30 to 40 feet girth at the earth, running up like a cone. The wood is extremely durable, and in high repute for shingles and posts. It is felled in winter, and allowed to dry thoroughly before being split. The trees, which grow, in a great measure, in water, have light barks, and are called *white cypress*, while those of drier soils are called *black cypress*, and yield a firmer and more resinous wood.

The *white cypress*, *C. thyoides*, is evergreen, grows seldom 70 feet high, and is about three feet in diameter. It is abundant in New-Jersey, Maryland, and Virginia, but not farther south. It inhabits salt and other marshes in dense forests. The wood is light, soft, of a rosy colour, aromatic, easily worked, and very durable. It is used by turners, and forms the most valuable shingles, sometimes called juniper shingles, which last 35 years.

CEDAR OF LEBANON. *Abies cedrus.* A tree of immense dimensions, value, and beauty, native on the Lebanon Mountains. It is naturalized in Europe, and is a splendid ornament in English parks. The wood is very durable. It may be cultivated with ease in the United States as an ornament.

CEDAR, RED. The *Juniperus Virginiana* is so called; it is found on the sea-coast from Maine to the Gulf of Mexico; attaining, in the South, 40 feet, but is small inland. It is evergreen and ornamental. The wood is very durable, light, and odorous, red in colour, but scarce in quantity: the best is from Florida.

CELERY. The improved smallage, or *Apium graveolens*. Several varieties are cultivated; the *white solid* is the best for the table, the *red solid* for cooking; *North's giant*, *new white*, *lion's paw*, and *celeriac* (*A. rapaceum*) are also raised; the last produces a root like the turnip, which is sliced, and eaten with vinegar. Early celery may be raised from seeds sown in a cold bed, like cabbages. The general crop is sown in March or April, in a rich border, protected from great heat. The drill is the best, run six inches apart. Transplant, when three inches high, into rich soil, and after a month into trenches dug one spade deep, ten inches wide, and four feet apart. Place at the bottom of each trench three inches of rotten dung, and mix it well with the soil; leave the earth taken out piled up between the trenches, to be afterward filled in as the plants grow. Trim the roots and side leaves of the celery before setting in the trench, and place them four to six inches apart. Sometimes two or more rows are planted in one wide trench. As the plants grow in the trenches, hoe them, and when well grown to one foot high begin to earth in; this must be done when the soil is dry. Place a board against the plants, and throw in soil enough to reach nearly to the central bud; do this on each side and along the row. Earth up every two weeks, as the celery grows, taking care to collect together the leaves each time. When blanched for thirty inches it is fit for use. Late winter celery may be put in trenches in August, and earthed in October. Market gardeners plough out their trenches, increasing the distance between them. One ounce of seed yields upward of ten thousand plants. The winter store is kept in sand, and covered with straw; sudden thawing destroys the celery. If the whole root is taken up uncut, the stump, after cutting off the head, will again sprout in a warm cellar, and yield a second supply of small, but very sweet and tender celery. Seeds are readily obtained by leaving a few plants in the seed-bed, which will flower in July, and bear an abundance of seeds in umbels.

CELL. In physiology, the minute cavities in plants and membranes: the size differs from the one thousandth to the one hundredth of an inch. It may contain air, or fluids and solids. The cell is the first structure of all membranes, but subsequently it may be converted into a tube. They are originally spherical, but become changed by pressure into cubes, dodecahedrons, and other figures.

CELLULAR TISSUE. The membrane or tissue in plants and animals which consists of cells containing gas chiefly, as the pith. It exists between all muscles, and under the skin in animals.

CEMENT. A *Mortar*, which see.

CEMENTATION. A process of making steel, by surrounding plates of iron with charcoal powder and heating to a high point.

CENTIGRADE. A division into one hundredths, as the centigrade thermometer.

CENTIPEDE. Creeping, wingless insects with many feet: they attack the dead roots of plants.

CENTRE OF GRAVITY. An imaginary point in the centre of any mass which has the same weight of matter arranged on at least two sides. When any substance is balanced on a point, as the finger, the centre of gravity lies immediately above that point. In falling to the earth, all substances take such a path that the centre of gravity descends in a straight line. No object can remain firm except a line drawn from the centre of gravity to the earth fall within its base; the instant it falls on the outside the body tumbles over.

CENTRIFUGAL (from *centrum, the centre*, and *fugio, I retreat*). Used in botany to describe an inflorescence in which the uppermost or central flowers bloom first.

CENTRIPETAL (from *centrum* and *petro, I seek*). That inflorescence in which the outermost or lowest buds develop first: it is the most common.

CEPHALIC (from *κεφαλη, a head*). Relating to the head.

CERACEOUS (from *cera, wax*). In botany, waxy.

CERASIN. The gum of the cherry and other trees, which does not dissolve, but swells in water; it is the same as bassorin.

CERATE. An ointment containing wax.

CEREALIA. A term applied to wheat, barley, rye, oats, corn, millet, or grain plants.

CERIN. That portion of wax which dissolves in boiling alcohol.

CERUMEN. The wax formed in the ears of animals. An accumulation produces deafness, that may be partly cured by syringing the ears with tepid water.

CERUSE. *White-lead*, which see.

CERVICAL (from *cervix, the neck*). Belonging to the neck.

CESPITOSE, CESPITOSUS (from *cespes, a turf*). Producing many stems from one root.

CHAFF. The husks of grain or straw cut in small pieces.

CHAFF ENGINES. The English name for *Straw-cutters*, which see.

CHALCEDONY. A semi-transparent, silicious mineral, usually milky and nodular.

CHALDRON. A measure of 36 bushels, heaped.

CHALK. A geological formation abounding in Europe, but absent in the United States. It belongs to the uppermost portions of the secondary formation, and consists of a large proportion of carbonate of lime.

CHALYBEATE. Medicines or mineral waters containing iron: they are tonic.

CHAMOMILE. *Anthemis nobilis.* The flowers are used in medicine as a bitter; or an extract is made of their boiled liquor. See *Camomile.*

CHAMPIGNION. The French name for mushrooms; also the *Agaricas orcades*, an English species, tougher, but more highly flavoured than the common mushroom; it is good when dried, and used in powder as a condiment, or made into catsup.

CHANGE OF SEED. Practical men have discovered that highly improved seeds, especially of wheat, corn, &c., brought from a distance, gradually deteriorate if the soil is unsuited. Thus, the white May wheat becomes red on the red soils of Virginia; the delicate six weeks' corn of Canada becomes a three months' hard corn in the South. General Harmon has shown that many of the choicest English wheats produce imperfect grain in New-York; and it must be evident that whatever improvement in plants and seeds has been attained by high culture, will be lost unless that culture is maintained. Instead, therefore, of changing seed, it is best to improve our own, and keep the land up to the proper tilth; and if we introduce new varieties, to take care to introduce, also, high culture. Seeds of the same state, or a similar soil and climate, deteriorate less rapidly than foreign grain. By changing seed and always buying choice kinds, fine grain may be obtained for one or two seasons, even from indifferent lands.

CHARCOAL. Vegetable matter burned in a place without access of air. Near large cities a strong vinegar (pyroligneous acid) is made from green wood, by distilling it in iron vessels; fine charcoal remains in the vessel, and is thus obtained for combustion. On the farm, the production of charcoal must be on a cheaper and more wholesale scale. Logs of wood are piled either horizontally or vertically into a dome-shaped mass, a chimney being left in the centre about four or five inches square, and the rest covered close with sods and earth a foot deep, so that no smoke can escape through it; a small flue or channel for air may also be left along the ground, under the wood, on the windward side, and passing to the central chimney: this is the simplest construction. Sometimes a pit or walled space is used, in which the wood is laid, flues being sunk to convey air to the bottom, and a central chimney left, the top being covered with earth, ashes, or cinders. The kiln is fired by placing in the central chimney leaves, straw, or twigs well lighted, and allowing the draught to remain open until the upper logs of wood are well fired, afterward closing the under flue. As soon as the flame dies away, the wood being red-hot above, close the top of the chimney and let the fire smoulder. It requires from six to ten days to burn a kiln, and constant attention must be paid. Hard wood requires most time. The average yield is 16 per cent. of coal, but hard woods, well burned, sometimes furnish 25. Box, lignum vitæ, mahogany, chestnut, and oak yield most. In this process, nearly all the *carbon* of the wood is left, the *oxygen* and *hydrogen* uniting in combustion to form water, and the object in view is to keep out atmospheric air, which would cause the combustion of the carbon also.

Properties. — Charcoal possesses many remarkable properties. 1st. It has the power of removing fetid smells from water, meats, and manures; hence it is used in disinfecting privies and manures. 2d. It removes the colour of many fluids, and is used in clarifying juices and solutions, especially in refining sugar. 3d. It is remarkably porous, and absorbs from the air and other media, gases: 1 cubic inch of fresh box-wood was found by Saussure to absorb and condense 90 of ammoniacal gas, 35 of carbonic acid, $9\frac{1}{4}$ of oxygen, and $7\frac{1}{2}$ of nitrogen: this property gives it great value in putrescent composts, and as a manure. 4th. Charcoal is nearly unchangeable in common air at the ordinary temperature, but burns, when heated to redness, into *carbonic acid*, if abundance of air be present. 5th. Being a very bad conductor of heat, it is used to line refrigerators and small ice-houses.

As a Manure.—Charcoal, in small lumps or coarse powder, has been highly recommended of late as a top dressing. About 40 bushels the acre, over grass lands, or among young plants, as turnips, has been known to produce a heavy increase. Its success will, however, depend upon the goodness of the soil, and its wants. Wherever an increased supply of ammonia from the air is wanting, the charcoal does good. The fresh-burned article also contains much saline matter, soluble in water. The best, and perhaps only advisable way of using it, is to compost the powder with night soil, urine, blood, and other putrescent bodies; it tends to dry up the fluids, and retains the ammonia formed during their decay. Such composts added to the soil, retain their virtue much longer than the bodies when used alone. The charcoal yields to roots of plants the gases it has absorbed. But it has been shown by numerous gardeners that charcoal powder, kept moist with rain water, is a good soil for many flowers, and capable of sustaining vigorous vegetation, and that slips take root readily in it. Besides its absorbent action, charcoal will loosen tough soils and increase their warmth by its black colour: it adds to the tilth by giving greater porousness.

Great difficulty has been found in obtaining powdered charcoal; this is readily obviated by crushing the lumps in a rough bark mill, which every farmer can set up with an old stone, turning around a post and pressing on a few flag-stones. See *Mill.*

CHARCOAL, ANIMAL. BONE BLACK, IVORY BLACK. These terms are used chiefly to indicate bones charred by heat. It is prepared extensively for sugar refiners, being much more valuable in removing colours than common charcoal. Sometimes it is made by placing bones in an open iron vessel and heating until they are sufficiently black; but the most economical way is to introduce crushed bones into iron retorts and distilling; by this means a strong fetid ammonia is obtained from them, which is very valuable in the arts, and the bones yield more bone black. Common animal charcoal contains 80 to 85 per cent. of phosphate of lime and mineral matter. The refuse of the sugar refiners is a very valuable manure, and, mixed with composts, much superior to the recent bone black, from the mixture of blood and other putrescent matters used. In France it is so highly esteemed, that purchases are made in New-York city for exportation to Havre, and the refuse is imitated by artificial mixtures of powdered charcoal and bullocks' blood. It is of great service in producing vigorous growth, strong plants, and fine seeds. From 150 to 200 pounds, in compost, are sufficient for an acre of land in high order: in gardens more is used.

CHARD. A variety of *Beet*, which see.

CHARLOCK. Several weeds of the *Cruciferous* family; difficult to extirpate except by mowing before they flower. They are annuals.

CHARRING. Burning so as to produce a crust of charcoal. It is a good way of preserving the butts of posts inserted in the ground or wet places.

CHASE. A row of trees or hedge plants.

CHAT POTATOES. A term in England for the small, imperfect potatoes, fit only for hogs.

CHEAT, or CHESS. The *Bromus secalinus* (see *Bromus*). Supposed to be degenerate wheat by the ignorant. It is a troublesome grass, only to be extirpated by cleaning the grain thoroughly of the chess seeds. It is called *Darnel* occasionally in England.

CHEESE. In making cheese there are certain general principles which are essential, but slight variations in the process produce cheeses of very different qualities; and although the most important circumstance is the nature of the pasture on which the cows are fed, yet much depends on the mode in which the different stages of the fabrication are managed; and hence the great superiority of the cheeses of particular districts or dairies over those of others, without any apparent difference in the pasture. By skill and great attention excellent cheeses are made in places where the pastures are not considered so well adapted to produce milk of a proper quality; and in those countries where the cows are chiefly kept tied up in stalls, and are fed with a variety of natural and artificial grasses, roots and vegetables, superior cheese is often made.

The first process in making cheese is to separate the curd from the whey, which may be done by allowing the milk to become sour; but the cheese is inferior in quality, and it is difficult to stop the acid fermentation and prevent its running into the putrefactive. Various substances added to milk will soon separate the curd from the whey. All acids curdle milk. Muriatic acid, or spirits of salt, is used with success for this purpose in Holland. Some vegetables contain acids which readily coagulate milk, such as the juice of the fig-tree, and the flowers of the *Galium verum*, or yellow lady's bed straw, hence called *cheese-rennet*. Where better rennet cannot be procured, they may be substituted for the most natural curdler of milk, which is the prepared stomach of a sucking calf. This rapidly coagulates the milk; and the only difficulty is in keeping it from putrefaction, which begins from the instant the stomach is taken from the calf. The preparation of the *rennet*, as it is called, is a most important part of the process of cheese-making. The following may be considered as the simplest, and perhaps the best. As soon as a sucking calf is killed the stomach should be taken out, and if the calf has sucked lately, it is all the better. The outer skin should be well scraped, and all fat and useless membranes carefully removed. It is only the inner coat which must be preserved. The coagulated milk should be taken out and examined; and any substance besides curd found in it should be carefully removed. The serum left in it should be pressed out with a cloth. It should then be replaced in the stomach with a large quantity of the best salt. Some add a little alum and saltpetre; others put various herbs and spices, with the view of giving the cheese a peculiar flavour, but the plain, simple salting is sufficient. The skins, or vells, as they are called, are then put into a pan, and covered with a saturated brine, in which they are soaked for some hours; but there must be no more liquor than will well moisten the vells. They are afterward hung up to dry, a piece of flat wood being put crosswise into each to stretch them out. They should be perfectly dried, and look like parchment. In this state they may be kept in a dry place for any length of time, and are always ready for use. In some places, at the time of making cheese, a piece of a vell is cut off and soaked for some hours in water or whey, and the whole is added to the warm milk. In other places, pieces of vell are put into a linen bag and soaked in warm water, until the water has acquired sufficient strength, which is proved by trying a portion of it in warm milk. The method employed in Switzerland is as follows: A dry vell is taken and examined; it is scraped with a knife, and where any veins or pieces of tough membrane appear they are removed. The whole surface is examined and washed carefully, if any dust or dirt has adhered to it; but otherwise it is only wiped with a cloth. A handful of salt is then put into it, and the edges of the vell are folded over and secured with a wooden skewer stuck through it. In this state it forms a ball of about three inches' diameter, and is laid to soak twenty-four hours in a dish containing about a quart of clear whey, which has been boiled, and all the curd taken out. The next day the vell is well squeezed, and put into fresh whey, the first infusion being put into a proper vessel; the second is afterward mixed with it and bottled for use. Half a pint of this liquor, of a proper strength, is sufficient to curdle forty gallons of milk. Experience alone enables the dairyman to judge of the strength of his rennet; for this purpose he takes in a flat ladle some milk which has been heated to about 95° of Fahrenheit, and adds a small measure of rennet. By the rapidity with which it curdles, and the form of the flakes produced, he knows its exact strength, and puts more or less into the caldron in which the milk is heated for curdling. A simple instrument might easily be invented by which the exact degree of strength might be ascertained, and a rule given to guide the less experienced; but as long as a man feels a superiority acquired by experience alone, he is not likely to encourage any contrivance which would place others on a level with himself. From this cause even the thermometer has not been introduced generally into any great dairy, nor have any certain rules been given to ascertain the exact heat required in the milk, when the rennet is added, to form the best curd.

There are different kinds of cheese, according to the mode of preparing it; soft and rich cheeses are not intended to be kept long; hard and dry cheeses are adapted to be kept and stored for provisions. Of the first kind are all cream cheeses, and those soft cheeses called Bath and Yorkshire cheeses, which are sold as soon as made, and if kept too long become soft and putrid. Stilton and Gruyere cheeses are intermediate; Parmesan, Dutch, Cheshire, Gloucestershire, and similar cheeses are intended for longer keeping. The poorer the cheese, the longer it will keep; and all cheese that is well cleared from whey and sufficiently salted will keep for years. The small Dutch cheeses called Edam cheeses are admirably adapted for keeping, and form an important article in the victualling of ships.

The *Gruyere* and *Parmesan* cheeses only differ in the nature of the milk, and in the degree of heat given to the curd in different parts of the process. Gruyere cheese is entirely made from new milk, and Parmesan from skimmed milk. In the first nothing is added to give flavour; in the latter saffron gives both colour and flavour: the process in both is exactly similar. A large caldron in the shape of a bell, capable of holding from 60 to 120 gallons of milk, hangs from an iron crane over a hearth where a wood fire is made. The milk, having been strained, is put into this caldron, and heated to nearly blood heat (95° to 100°). It is then turned off the fire, and some rennet, prepared as stated above, is intimately mixed with the warm milk by stirring it with a flat wooden skimming dish, which is turned round in the milk. A cloth is then laid over the caldron, and in half an hour, more or less, the coagulum is formed. This is ascertained by pressing the skimming dish on the surface, when the whey will appear on the part pressed. If it is longer than an hour in coagulating, the milk has been too cool, or the rennet not strong enough. The weather has a great influence on the process of the dairy, and there is much yet to be learned by accurate observations with meteorological instruments. When the curd is properly formed, it is cut horizontally in thin slices by the same skimming ladle. Each slice, as it is taken off, is placed along the side of the caldron which is nearest to the operator: by this means every portion of the curd rises successively to the surface, and is sliced thin. The whole is then well stirred, and the caldron replaced over the fire. A long staff, with a small knob of hard wood at the end, and which has smaller cross pieces or sticks passed through holes in it at right angles to each other near the end, is now used to stir and break the curd, and the heat is raised to about 135°. The caldron is again swung off the fire, and the curd is stirred with the staff, which is moved round with a regular rotatory motion. After stirring in this manner nearly an hour, the curd is found divided into small dies about the size of a pea, which feel elastic and rather tough under the finger. The whey, of which a portion is removed occasionally, now floats at top, and the curd is collected in the bottom by giving a very rapid rotatory motion to the contents of the caldron by means of the staff. A cloth is now introduced into the bottom, and all the curd collected over it; it is raised by the four corners, and laid on an instrument like a small ladder, which is placed across the mouth of the caldron. The whey runs out through the cloth, which is a common cheese-cloth woven with wide interstices; and the curd in the cloth is placed in a shape or hoop made of a slip of wood four inches and a half wide, the two ends of which lie over each other, so that the diameter can be increased or lessened. A cord fixed to one end of the hoop is passed with a loop over hoops on the outer surface of the other end, and prevents the ring from opening more than is required. The curd is pressed into this ring with the hands, and the ends of the cloth are folded over it. A round board, two inches thick, and strengthened by cross pieces nailed on it, is placed over the curd, and the press let down upon it.

The cheese-press is a simple long board or frame forming a lever, loaded at one end and moving in a frame at the other.; it is lifted up by another lever connected with it, and let down on a strong stick, which stands with its end on the centre of the board last mentioned. The weight is thus easily removed or replaced. The hoop containing the cheese is placed on a similar board, and from it the table of the press slopes towards a wooden trough, which receives the whey as it runs out. In an hour after this the curd is examined; the edges, which are pressed over the ring, are pared off, and the parings are put on the centre of the cheese; a fresh cloth is substituted, and the whole cheese is turned.

The ring, which opens readily by unhooking the cord, allows the cheese to come out, and is put on again and tightened. This is repeated two or three times in the day. In the evening, a small portion of finely powdered salt is rubbed on each side of the cheese, and it remains in the press till the next morning. It is now again rubbed with salt, and placed on a shelf with a loose board under it. The wooden ring remains on the cheese for two or three days, and is then taken off. This is the whole process.

During the next six or eight weeks the cheeses are turned and wiped every day, and a small quantity of fine salt is sifted on the surface and rubbed in with the hand until it will take no more. The cheese-room is always very cool, and little light is admitted. A free circulation of air is essential. The cheeses are in perfection in about six months, and will keep two years. A quantity of elastic fluid is disengaged in the ripening, and forms those round cells which are a peculiar feature in these cheeses. The smaller and rounder the cells, the better the cheese is reckoned. They should contain a clear salt liquor, which is called the tears; when these dry up, the cheese loses its flavour. These particulars will give any one unacquainted with the dairy a tolerable notion of the process of cheese-making in general.

In *Cheshire* the making of cheese is carried on in great perfection, and the greatest pains are taken to extract every particle of whey. For this purpose, the curd is repeatedly broken and mixed, the cheeses are much pressed, and placed in wooden boxes which have holes bored into them. Through these holes sharp skewers are stuck into the cheese in every direction, so that no particle of whey can remain in the curd. The elastic matter formed also escapes through these channels, and the entire cheese is a solid mass without holes, which in this cheese would be looked upon as a great defect. The salt is intimately mixed with the curd, and not merely rubbed on the outside. This checks internal fermentation, and prevents the formation of elastic matter.

Gloucester and *Somersetshire* cheeses are similarly made, with this difference, that the curd is not so often broken, or the cheese skewered, and a portion of the cream is generally abstracted to make butter. After the curd has been separated from the whey and is broken fine, warm water is poured over it for the purpose of washing out any remaining whey, or perhaps to dissolve any portion of butter which may have separated before the rennet had coagulated the milk; for although cream adds to the richness of cheese, butter tends to make it rancid.

Stilton cheese is made by adding the cream of the preceding evening's milk to the morning's milking. The cream should be intimately incorporated with the new milk; great attention should be paid to the temperature of both, and much of the quality of the cheese depends on this part of the process. To make this cheese in perfection, as much depends on the management of the cheese after it is made as on the richness of the milk. Each dairy has some peculiar method which is considered best; and it is certain that there is the greatest difference between cheeses made in contiguous dairies. The rennet should be very pure and sweet. When the milk is coagulated, the whole curd is taken out, drained on a sieve, and very moderately pressed. It is then put into a shape in the form of a cylinder, eight or nine inches in diameter, the axis of which is longer than the diameter of the base. When it is sufficiently firm, a cloth or tape is wound round it to prevent its breaking, and it is set on a shelf. It is occasionally powdered with flour, and plunged into hot water. This hardens the outer coat, and favours the internal fermentation, which ripens it. Stilton cheese is generally preferred when a green mould appears in its texture. To accelerate this, pieces of a mouldy cheese are sometimes inserted into holes made for the purpose by the scoop called a *taster*, and wine or ale is poured over for the same purpose; but the best cheeses do not require this, and are in perfection when the inside becomes soft like butter, without any appearance of mouldiness. In making very rich cheeses, the whey must be allowed to run off slowly, because, if it were forced rapidly, it might carry off a great portion of the fat of the cheese. This happens more or less in every mode of making cheese. To collect this superabundant butter, the whey is set in shallow pans, as is done with milk when butter is made; and an inferior kind of butter, called *whey butter*, is made from the cream or fat skimmed off.

Cheeses are frequently coloured, a practice which probably arose from the notion of making the cheese look richer; but now it deceives no one. Yet if some cheeses were not coloured, they would not be so marketable, owing to the association that subsists between the colour and the quality of the cheese. The substance used for colouring is most commonly arnotto, which is ground fine on a stone, and mixed with the milk at the time the rennet is put in. The juice of the orange carrot and the flower of marigold are also used for this purpose. This last gives a more natural tint than the arnotto, which is too red.

Dutch cheeses are made in a very similar manner to the Gloucester cheeses, but the milk is generally curdled by means of muriatic acid or spirits of salt; and great care is taken to prevent fermentation, and to extract the whole of the whey. For this purpose, the curd is repeatedly broken and pressed; and before it is made up into the round shape in which it is usually sold, the broken curd is well soaked in a strong solution of common salt in water. This diffuses the salt throughout the whole mass, and effectually checks fermentation. When the cheeses are finally pressed, all the whey which may remain is washed out with the brine; salt is likewise rubbed over the outside, and they are set to dry on shelves in a cool place. The flavour of the cheese is perhaps impaired by the stoppage of the fermentation; but it never heaves, and it acquires the valuable quality of keeping well even in warm climates. From the place where this cheese is commonly made, it is known by the name of Edam cheese. A finer cheese is made at Gouda and other places, by imitating the process in making Gruyere cheese; but this cheese is always full of small cavities, and will not keep so long as the Edam. The little cheeses made from cream and folded in paper, called *Neufchâtel* cheeses, can be easily imitated, being nothing more than cream thickened by heat, and pressed in a small mould. They undergo a rapid change, first becoming sour and then mellow, in which state they must be eaten.

The green Swiss cheese, commonly called *Schabzieger*, is made in the canton of Glarus, and is by many persons highly esteemed. The curd is pressed in boxes with holes to let the whey run out; and when a considerable quantity has been collected, and putrefaction begins, it is worked into a paste with a large proportion of a certain dried herb reduced to powder. This herb, called in the country dialect *Zieger kraut* (curd herb), is the *Melilotus officinalis*, which is very common in most countries, and has a peculiar aromatic flavour in the mountains of Switzerland. The paste thus produced is pressed into moulds of the shape of a common flower-pot, and the putrefaction being stopped by the aromatic herb, it dries into a solid mass, which keeps unchanged for any length of time. When used it is rasped or scraped, and the powder, mixed with fresh butter, is spread upon bread. It is either much relished or much disliked, like all those substances which have a peculiar taste and smell.

When a cheese which has been much salted and kept very dry is washed several times in soft water, and then laid in a cloth moistened with wine or vinegar, it gradually loses its saltness, and from being hard and dry becomes soft and mellow, provided it be a rich cheese. This simple method of improving cheese is worth knowing. It is generally practised in Switzerland, and cheeses are kept stored there for many years; if they were not very salt and dry, they would soon be the prey of worms and mites. A dry Stilton cheese may thus be much improved.

CHEESE, EXPORTATION OF. The exportation of cheese to England is becoming very heavy; 179,389 cwt. were imported into Great Britain in 1844, nearly one third being from the United States. The cheese to imitate is the Cheshire, but if Stilton could be produced it would pay a heavy profit.

CHEESE-CLOTH. A coarse open cloth or towel placed inside the vat; it should be wrung out in boiling water after use, and dried.

CHEESE, CONNECTICUT. The following account from the *American Agriculturist* gives the process for the preparation of a very excellent cheese:

"On a farm capable of supporting twelve cows, two cheeses of about 10 lbs. each may daily be made, in the months of May, June, and July. The evening's milk is kept untouched till the next morning, when the cream is taken off and put to warm in a brass kettle, heated in order to bring it to the temperature of new milk from the cow. The cows being milked early in the morning, the morning's new milk and the night's milk prepared as above are put into a large tub together, with the cream. Then a portion of rennet, which has been soaked in water milk-warm the evening before, and sufficient to coagulate the milk, is put into the tub, after which it is covered up warm and left to stand about half an hour, or till coagulated, at which time it is turned over with a bowl to separate the whey from the curd, and broken soon after with the hand and bowl in very small particles; the whey being separated by standing some time, is taken from the curd, which sinks to the bottom. The curd is then collected into a part of the tub, and a board is placed thereon which weighs from 60 to 120 lbs., to press out the whey. When it is getting into a more solid state, it is cut and turned over in slices several times to extract all the whey, and then weighted as before. These operations may occupy about an hour and a half. It is then taken from the tub and broken very small by the hand, or cut very fine by a cheese knife, and put into a cheese vat, enlarged in depth by a hoop to hold the quantity, it being more than the bulk when finally put to the press. The side is pressed well by hand, and with a board well weighted placed at the top. The cheese is thus drained of its whey, then shifted out of the vat, having a cloth first spread on the top of it, and reversed on the cloth into another vat, or even into the same, which, however, must be always fresh scalded, and thus made warm before the cheese is returned into it. The top part is now broken down to the middle, has salt mixed with it, is reversed as before, then pressed by hand, weighted, and has the remaining whey extracted. This done, the cheese is again reversed into a scalded warm vat, with a cloth beneath the cheese; a hoop is also put round the upper edge of the cheese and within the sides of the vat, the cheese being first enclosed in a cloth, and the edge of it put within the vat. Finally, it is put into a press of thirteen pounds weight and pressed very hard. In four hours it is shifted and turned, and after four hours again treated in the same manner. After this it is taken out and carried to the drying-room, and turned every day until it grows hard."

CHEESE-KEEPING. The ripening of cheeses is all important in improving their flavour. A constant temperature of from 50° to 65° Fahrenheit is the proper degree, but this can only be attained in caverns and cellars built for the purpose. Cheeses are kept well when covered with a cotton cloth and whitewashed.

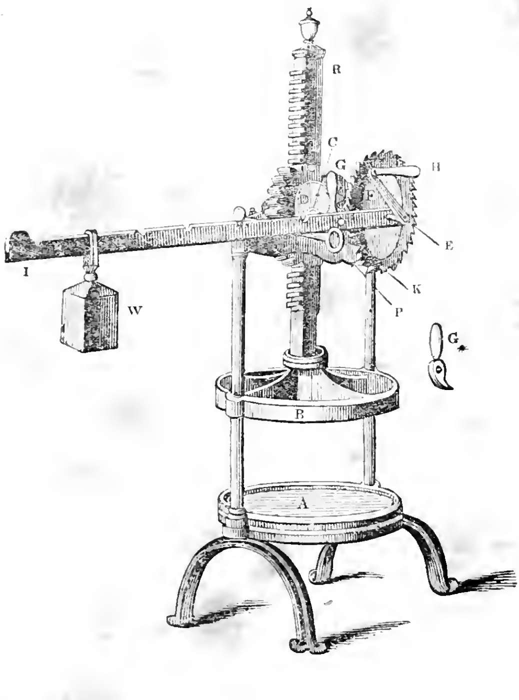
CHEESE MAGGOT. The larva of a dipterous fly (*Piophila casei*) found in decaying cheese.

CHEESE MITES. Minute, wingless insects (*Acarus siro*) with eight legs. Their introduction into cheeses is very mysterious, as they appear when no wounds are to be seen on the outside.

CHEESE, PINEAPPLE. The following is the plan of Mr. Davenport, of New-York, who received the prize of the American Institute:

"In all cases the milk and rennet should be sweet. When the curd is properly produced, break it up very fine, cook it well, but not to overheat. Season with clean pure salt. Put the cheese or curd into the press or mould, which is of pineapple shape, with a neck, and open in the centre, and fastened together by clamps or clasps. Fill the mould full, also the neck, and press with a round follower to fit the neck. Keep it in the press twenty-four hours, take the cheese out and cut off the neck, and sear it over; then dip it in hot whey to form a hard rind, and draw over them tightly a net with interstices of a diamond shape, which forms the indenture. Suspend them from the neck, and keep them so for four weeks; then take them out of the nets, and set them on trenches on shelves, and in three months they are cured and fit for market. Pack them in cases of ten each, with partitions between them."

CHEESE PRESS. The most common kind is described in the article *Cheese*. Numerous improved machines occur, but the following, by Baird, is in all respects equal, if not superior, to the rest, and extensively used in the English cheese counties.



"The form containing the curd is put on the bottom plate, A, and the top plate, B, is made to descend and press on it. There are two ways of doing this: one quick and easy, until the resistance becomes great; and the other slower, but more powerful, and used for the conclusion of the operation. On the axis, C, of the wheel, D, there is a pinion of eight teeth (not seen in the engraving) which works in the rack, R. On the axis, E, there is another pinion of eight teeth (concealed by the other parts), which acts in the wheel, D, of twenty-four teeth. This axis, E, may be turned by the winch handle, H, three turns of which will make the rack descend through a space corresponding to eight of its teeth. In this way the plate, B, may be lowered to touch the cheese, and to commence the pressure; but when the resistance becomes considerable, the second method of acting on the rack must be resorted to. On the axis, E, besides the pinion before mentioned, there is a fixed ratchet wheel, F; the lever, I, forked at the end, which embraces F, is also placed on this axis, but turns freely round it. In the forked part of F there is a ratchet or click, G (better seen at G *), which, turning on the pin, K, may be made to engage in the notches of the ratchet wheel, F. By means of this arrangement, when I is raised up, and G engaged in F, the axis, E, and its pinion will be turned round with great power on depressing the end, I, of the lever; and by alternately raising and depressing I, any degree of pressure required may be given to the cheese; after which, if it be wished to continue the pressure, and to follow the gradual shrinking of the cheese, the lever is to be raised above the horizontal position, and the weight, W, hung on, which will cause it to descend as the cheese yields. By inserting the pin, P, this effect may be discontinued, and the farther descent of B prevented." — (*Highland Soc. Trans.*, vol. x., p. 52.)

CHEIROPTERA (from χειρ, *the hand,* and πτερον, *a wing*). Animals of the *bat* kind, whose wings are membranous, stretched from the hand and arm to the hind legs and side of the body. Bats are, for the most part, insectivorous, and therefore worthy of preservation by farmers.

CHELONIANS (from χελωνη, *a tortoise*). All tortoises, turtles, &c., which are covered with a double shell.

CHEMISTRY (*Chama, Arb., to burn*). The science which investigates the nature of matter, and the laws which govern the movements of its atoms. The inanimate and animate world are the scenes of its researches. The miner, dyer, and manufacturer owe their success to chemistry, and the farmer is destined to be more benefited by this science than other professions. The soil, plants, and manures are all topics of chemical examination, and, without knowing their nature, no person can practice agriculture except by guess, and in an empirical way.

It is a subject of immense extent, and in this work I have confined myself to the practical points. See *Analysis*, *Affinity*, *Atom*, *Oxygen*, *Carbon*, *Ammonia*, *Phosphorus*, &c.

CHENOPODIACEÆ. A family of plants, of which the *Chenopodium* is a genus. They are herbaceous, growing on very rich lands, have a solitary carpel, stamens of the same number as the divisions of the calyx, without bracts or petals. The wormseed (*Ch. anthelminticum*) is the only medicinal species. Beets, spinach, and goose foot belong to this family; the leaves, and indeed the whole plant, are mucilaginous, and may be eaten as food when not unpleasant to the palate.

CHERIMOYA. The fruit of the *Anonà cherimolia*, a tree of tropical America.

CHERRY. *Prunus cerasus.* The tree grows well in the United States, and prefers a deep loam in a free exposure. The wood is firm, and used for cabinet purposes. The stocks are raised from seed, and budded or grafted: for dwarfs, the morello stock is preferred. The stock may be budded the first year, and will bear in the fifth. They may be trained as espaliers or left as standards. The following are select varieties :

Davenport's Early Black, *New May Duke.*—This variety is considered as one of the finest and most productive of early cherries known. The fruit is of medium size, heart-shaped, of a dark, glossy black colour : flesh firm, and of a pleasant, sub-acid flavour. It ripens a week or ten days earlier than the May Duke.

May Duke, *Early Duke, Holman's Duke, June Duke.*—Fruit roundish, and grows in clusters ; skin very dark red ; flesh soft and juicy : ripe in June.

American Amber, *Early Amber, New Honey.*—Fruit beautiful, and of medium size ; dark pink or amber colour ; flesh rich, sweet, and fine : ripe in June.

Elton.—This excellent variety was raised by Mr. Knight in 1806 ; the tree is very vigorous and productive ; the fruit is pretty large, heart-shaped ; pale glossy yellow in the shade, but marbled with bright red next the sun ; flesh firm, sweet, and rich : ripens soon after the May Duke.

Florence.—A very fine heart-shaped cherry, of a yellow amber colour, marbled with bright red in the shade, bright red next the sun ; flesh tolerably firm, juicy, rich, and sweet : ripe end of June and in July.

Ambree de Choisy. — A middle-sized, roundish fruit, highly deserving of cultivation ; skin transparent, red, mottled with amber ; flesh amber coloured, tender, and sweet. It bears well as a standard, and ripens its fruit in June.

Knight's Early Black. — Colour rich, dark hue ; flesh firm, juicy, and sweet : ripe in June.

Ox Heart, *Harrison's Heart, White Bigarreau.* — Fruit large, heart-shaped ; colour pale yellow and white, mottled with red ; flesh white, firm, and well flavoured : ripe in June.

Manning's Black Bigarreau.—A new variety from the nursery of the late R. Manning, of Salem, Mass. Fruit large, flesh sweet, and of peculiarly fine flavour : ripe in July.

Yellow Spanish, *Graffion, Imperial, White Orleans, Turkey Bigarreau.*—Fruit very large, heart-shaped ; amber colour, red next the sun ; flesh firm, sweet, and fine flavoured ; one of the very best varieties ; tree an abundant bearer : ripe in July.

Black Eagle.—A handsome variety ; fruit of globular form ; skin dark purple ; flesh tender, rich, and of fine flavour : ripe in July.

Black Tartarian, *Black Russian, Ronald's Large Black Heart.*—Large, heart-shaped, and of very superior quality ; colour dark shining purple or black ; flesh firm, purple, and sweet ; tree very productive : ripe in June.

Elkhorn, *Black Ox Heart, Large Black Bigarreau.* — Fruit large, and heart-shaped ; an excellent variety for market : ripe second and third weeks in July.

Archduke, *Royal Duke, Portugal Duke.*—A large, globular-formed red cherry ; like the May Duke, it grows in clusters, but the tree grows more vigorously than that variety, and yields an abundance of fruit, which hangs a long time on the tree, improving in flavour in July.

Napoleon Bigarreau.—One of the finest varieties ; fruit white, with red spots ; size large, flesh white, solid, and sweet : ripe in July.

White Bigarreau. — One of the largest and finest varieties. Fruit heart-shaped ; skin yellow, with a red cheek ; flesh firm and fine flavoured : ripe in July.

Late White Heart.—Middle size, pleasant flavour, valuable as a late variety : ripe the last of August.

White Tartarian.—An elegant fruit ; pale yellow, approaching to amber next the sun ; fine flavour, and a good bearer : ripe in July.

Downer's Late Red, *Downer's Favourite.*—Fruit large and round ; colour light red, flesh firm and fine : ripe after most other varieties are gone

Morello, *English Morello.*—Fruit of medium size, round ; of a dark-red colour, nearly black at maturity ;

flesh deep red, tender, juicy, and blended with an agreeable acid; ripe in July, and hangs some time on the tree. This variety is excellent for preserves and for brandy.

The fruit appears on spurs produced on branches two and three years old; the spurs are formed year by year along the bearing branches: the morello on the last year's shoots, and seldom on that three years old. Cherry-trees, unless topped, become very high, and require 30 to 40 feet between them.

Diseases.—Exudation of gum is cured by improving the soil, and pruning less carelessly. The *aphis*, of a green colour, is often troublesome, causing the leaves to curl, and producing, according to some naturalists, *honey dew.* Fumigations with tobacco, sulphur, and pepper are recommended, as well as washing by a garden engine, and throwing up tobacco infusion. The *red spider* is removed by the same means. It is, however, a healthy tree, and less subject to disease than many others. The trunk is sometimes attacked by *borers.*

CHERRY, WILD. *Prunus Virginiana.* This tree is found as far north as Maine, but reaches perfection in rich lands in the Middle States, especially Pennsylvania; and also in Virginia and Ohio. Trees have been measured 100 feet high and 16 in girth. The wood is brown, bright, and, near branches, well marked. It is much used for cabinet purposes, and is durable. The fruit is small and bitter, but flavoured like ratafia, from the presence of oil of bitter almonds, and is sometimes mixed with morello cherries for the manufacture of cherry brandy and cordials. The young tree is an excellent stock for budding or grafting. The bark, infused in water, forms a popular tonic and nervous remedy. For other varieties, see *Prunus.*

CHERT. A silicious mineral resembling flint.

CHERVIL. *Chærophyllum sativum.* A pot-herb resembling parsley, used by the French and Dutch in soups and as salads. The seeds are sown in spring, in drills eight inches apart, the plants thinned to eight inches apart, and kept free of weeds. It flowers in the fall.

CHESSEL. The cheese vat. It is made of white oak, bound by iron hoops, and perforated with holes to allow the whey to drain out.

CHEST FOUNDER. An irritation or inflammation of the membranes in the chest. See *Horse.*

CHESTNUT. The American chestnut (*Castanea Americana*) very nearly resembles the famous European tree (*Castanea vesca*), except in its altitude and the size of the fruit. The European, also called the Spanish or Italian chestnut, is of immense size and longevity, trees being known which have a girth of 60 feet. The wood, except in very old trees, is admirable, being more durable than oak in moist situations. The bark is also used in tanning. It prefers a dry, loose soil, abounding in silicious matter and potash.

The European variety is easily raised from seed, grows rapidly, and bears in seven years. The fruit is five times larger than that of ours, and commands a good price in the market. Chestnuts are used boiled, roasted, and raw. In Southern France, Italy, &c., they constitute the bread of a large population. Michaux gives the following directions for the cultivation of the chestnut:

"After the ground has been carefully loosened with the plough and harrow, lines are drawn six feet apart, in which holes about a foot in depth and diameter are formed, at the distances of four feet. A chestnut is placed in each corner of the hole, and covered with about three inches of earth. As the soil has been thoroughly subdued, the nuts will spring and strike root with facility. Early in the second year, three of the young plants are removed from each hole, and only the most thriving is left. The third or fourth year, when the branches begin to interfere with each other, every second tree is suppressed. To ensure its success, the plantation should be begun in March or

April, with nuts that have been kept in the cellar during the winter, in sand or vegetable mould, and that have already begun to germinate."

CHEWING THE CUD. The animals which chew the cud are termed by naturalists *Ruminants*, and include the ox, deer, camel, and sheep. They are furnished with four pouches or stomachs; the grass gathered on the field is swallowed and reaches the first pouch, is moistened by water from the second, and afterward moulded into round balls, which are thrown up into the mouth and leisurely chewed, and re-swallowed into the third stomach, to be digested in the fourth. Such animals are essentially herbivorous, and require rest during rumination. Any interference with this process is a sign of disease.

CHIASTOLITE. A mineral resembling soap-stone.

CHICA. A red colour obtained by boiling the leaves of the *Bignonia chica*, straining, and allowing to cool, when it settles as an insoluble red matter. It is permanent, insoluble in water, but soluble in oils and lyes. The Indians use it to anoint their bodies. It may be useful in the arts.

CHICKEN. See *Poultry*.

CHICK PEA. An exotic, leguminous annual, resembling the vetch: the *Cicer arietinum* of botanists. They have been raised in the Middle States with success. It is the *Garbanza* of Spain, and *Poischicæ* of the French, and reputed as the most delicious pea. The ground dry pea is also used in soups, and the roasted grain is said to be a good substitute for coffee. It prefers a rich, sandy loam, is grown in rows, does not climb, attains the height of about eighteen inches; the pods contain two peas, and the yield is small. As they come to most perfection in the South, they must be sown in June in the Middle States.

CHICORY. *Cichorium intybus*. An indigenous perennial plant, with fine blue composite flowers. (*See Figure.*)

The following is from Mr. Rham:

"It has a fusiform root like a carrot, from the crown of which large

and succulent leaves spread out, with deeply-indented edges. The whole plant is bitter and aromatic. It is frequently used as a salad, especially when blanched. For this purpose, the roots are taken up in the end of autumn; they are then placed in sand or light mould, in a cellar from which the light is excluded, the leaves having been cut off previously within half an inch of the crown. Fresh, slender leaves soon grow out of the root, and, being deprived of light, they are much more delicate and tender than those which grow in the open ground. The bitterness, also, is thus lessened, and they form a very pleasant winter salad, which, from the long, slender, and matted state of the leaves, the French call *barbe de capucin* (monk's beard). It is pleasanter to the taste than common endive.

"The luxuriant growth of the leaves of the chicory, and their speedy reproduction after they have been cut, suggested the more extensive cultivation of this plant as food for cattle and sheep, who are fond of the leaves. M. Cretté de Pannel, who cultivated it near Paris in a rich soil, produced extraordinary crops. The first year he cut it only twice, but afterward four and five times in a year: it produced more green food than any other plant cultivated for this purpose. Arthur Young was so struck with it that he strongly recommended it to the notice of British agriculturists; and in the queries sent to various parts of the country by the Board of Agriculture, one was whether chicory was cultivated in the district as green food for cattle. But, notwithstanding its abundant produce, it has not been found so much superior to other green food as to make its cultivation general. Some accurate experiments on a large scale were made in France, at the national farm of Rambouillet, to ascertain the value of chicory compared with lucern and other green food. The chicory was declared inferior, giving a disagreeable taste to milk and butter when cows are kept upon it. For sheep it is very good, and a small portion mixed with their other food may probably be a preservative against the rot.

"Chicory is now chiefly cultivated in Belgium and Germany, for the purpose of preparing from the root a powder which can be substituted for coffee. This has become a very considerable article of commerce.

"To have the roots in perfection, the seed should be sown, or, rather, drilled, in April, like that of the carrot. If sown sooner, they are apt to run to seed. The land should be rich, deep, and light. The plants should be thinned out to six inches in the rows, and most carefully weeded. In September the leaves should be finally gathered and the roots taken up, which may be done with a common potato-fork. They are then cleaned by scraping and washing, split where they are thickest, and cut across in pieces about two or three inches long. These pieces are dried by means of a slow oven or a kiln. Some nicety is required in drying, to prevent the root from being scorched, and to keep the proper flavour. In this state it is sold to the merchants, packed in bags. It is afterward cut or chopped into small pieces, roasted exactly as coffee, and ground in a mill. Chicory is said to exhaust the soil, and to require fresh ground to prevent its degenerating. Unless the soil is rich and light, the roots will not come to a good size in one season, and old roots become tough and stringy. It is only the young roots that are fit to be prepared for commerce. They lose a great portion of their weight in drying. The best preparation of the land for chicory is grass or clover. The manure should be laid on before it is ploughed up in autumn, which will accelerate the decomposition of the roots. The land should be ploughed very deep in spring, and laid light; the surface harrowed fine, and the chicory seed drilled in rows twelve inches apart, and rolled. Liquid manure spread over the ground will much accelerate the growth of the plants, which must be thinned out like turnips or carrots, to six or eight inches from plant to plant."

About thirteen pounds of seed are used to the acre.

CHIGOE, or CHIGGER. An apterous minute insect, which abounds in southern and tropical America. It penetrates the skin of the foot, growing to some size, and producing intolerable itching. Unless destroyed by tobacco juice, or picked out with a needle, it finally brings about ulcerations.

CHILIAN CLOVER. The *Alfalfa.* It is common lucern.

CHINE. The back bone.

CHINQUAPIN. *Castanea pumila.* A small tree and bush seldom found north of Delaware. The fruit is small and like a chestnut. It is seldom wood is obtained from the chinquapin: what there is is very durable. In neglected new lands in Virginia it is a great nuisance.

CHINTZ, or CHINCK BUG. The following is from Mr. Pleasants of Virginia:

"The chinck bug is a much more formidable enemy with us than the wheat worm, or even the Hessian fly. They (the chinck bugs) attack both corn and wheat crops, the latter in May, the former generally in the month of June. They continue to injure the wheat by extracting the sap as long as there is a particle of it in the stalk. The consequence is, where they are numerous, the grain, when harvested, is nearly worthless and the straw vastly injured. By the time the wheat is cut, the bugs (then flies) take wing, and immediately spread over the neighbouring corn-fields, concealing themselves under the blade slips, under the roots, &c., where they deposite millions of eggs, which are hatched in eight or ten days, and continue through rapidly succeeding generations to prey upon the sap as long as anything green remains upon the stalk, finally taking shelter for the winter under the bark of stumps and logs, under large clods, &c., to be ready for the work of destruction the next season. When first hatched, they are very small, and red as cochineal. They grow very rapidly, and in a week attain half the size of a bedbug; in a week more, they acquire wings, fly, and spread themselves over the field, depositing their eggs generally. They are, in the last state, about twice the size of a flea, have white wings, and their bodies being dark, have a speckled appearance. I have been thus minute in describing these insects, because I observe they have never been seen in Maryland." Their destruction is attempted by running ditches across the field, filled with straw, and, as soon as the bugs are seen thereon, setting fire to it. The bugs come from forests, and are destroyed by occasionally burning the dry leaves.

CHIVES, or CIVES. *Allium schænoprasum.* A small species of onion growing in tufts. It is propagated by dividing the roots, set out in May and June eight inches apart, and eight or ten offsets together. Keep free from weeds. The leaves may be used for soups. In the fall, as soon as the tops die, dig the chives and store for winter.

CHLORINE (from *χλωρος, green*). A green-coloured elementary gas, produced artificially. It is pungent, poisonous, and of great chemical activity. It exists only in combination in nature: equivalent 35·45. When combined with metals the substances are called *Chlorides*, as *chloride of sodium* (common salt), *chloride of hydrogen* (muriatic acid). The latter is a powerful acid, much used in the arts, and known under the name of spirits of salts. Chlorine also unites with lime and soda, forming feeble compounds, the chlorides of lime and soda; these, especially the former, are extensively used in bleaching, from the continual escape of the chlorine. They are also disinfecting for the same reason. Chlorides are often erroneously called *Muriates*. Chlorine unites with five equivalents of oxygen, and forms the *Chloric Acid.* One of its salts, the chlorate of potash, is of great value in the arts

CHLORITE. A mineral of a greenish colour, common in slates, &c. It is chiefly a silicate of magnesia and iron.

CHLORO. In chemistry, a prefix to substances containing chlorine, as chloro-carbonic acid, &c.

*CHLOROPHYL (from *χλωρος* and *φυλλον, a leaf*). The green colouring matter of leaves. It closely resembles wax, and is converted in the fall into a true yellow fat. The presence of chlorophyl is essential to the healthy functions of the leaf, which ceases to absorb carbonic acid from the air when yellow or red. The autumnal tints of leaves depend on a change of this colouring matter, the yellow being called *Zanthophyl*, and the red *Erythrophyl*. Chlorophyl is also called chromule by some authors. The tints of many flowers depend upon its compounds, which assume every variety between reds, yellows, and greens. Chlorophyl has been very recently shown to be analagous, in its physical characters, with indigo.

CHLORURETS. The old name for *Chlorides*.

CHOCOLATE. A preparation made by triturating the roasted cocoa beans at a temperature of 130° Fahrenheit, and mixing with cinnamon, cloves, vanilla, or other spices.

CHOKE DAMP. The suffocating vapour existing in the bottom of wells, cess-pools, and mines of wood coal. It is an air containing much carbonic acid, and may destroy life. Free exposure to pure air and artificial warmth are the means to be used in restoring persons overcome with this vapour.

CHOLESTERINE (from $\chi o \lambda \eta$, *bile*, and $\sigma \tau \epsilon \alpha \rho$, *suet*). A fatty matter resembling spermaceti, found in the bile and biliary concretions.

CHOLEIC ACID. Liebig regards the animal matter of the bile as choleic acid, the secretion being a soap formed by its union with sŏda. *Cholic* and *choloidic* acids are separated by alcohol and other solvents, and are of secondary consequence. Redtenbacher has recently discovered *twenty-six per cent.* of sulphur in choleic acid.

CHONDRINE. Gristle, or cartilage. It consists of protein with water, or, according to Liebig, protein +2O, +4 water.

CHORD. A straight line drawn between the two extremities of the arc of a curve. The chord of an arch is its span.

CHOROID MEMBRANE. The membrane of the eye within the white coat.

CHROMATIC (from $\chi \rho \omega \mu \alpha$, *colour*). In optics, relating to colour.

C H R O N I C (from $\chi \rho o \nu o \varsigma$, *time*). Diseases which are slow in their progress are called chronic.

CHRYSALIS. The grub or inactive state of changeable insects. The terms pupa and aurealian are synonymous. Some are enclosed in cocoons, others are destitute of covering, and buried in the earth or in trees. Moths usually have rounded and butterflies angular chrysales.

CHURN. The barrel in which the butter of milk is separated. The common plunging churn is described in the article *Butter*. Another form is a barrel with paddles moving upon a central axis, which is turned by a handle on the outside. Churns are moved by horse or dog power, water, and even steam-engines. A simple plan is to affix the rods of several plunging churns to a cross-bar attached to a lever, one end of which is fastened to a wall or tree by a moveable joint; by moving the free end of the lever, all the sticks are raised or depressed together, and thus four or more churns are set in action by one person. The French use a churn made of tin, which being placed in a tub of warm water, can be warmed directly, and be made to yield butter in from ten to twelve minutes.

CHURNING. From a series of experiments made for the Highland Agricultural Society, it appears that temperature of 50° or 55° Fahrenheit is the best for the process (with cream), and about two hours' work. If the churning be continued after the formation of butter it becomes soft, and sometimes looses its colour. When the whole milk is used it should be warmed to 65° Fahrenheit. As this point is easily managed in summer as well as in winter, it is best to use the entire milk. An additional argument is, that more butter is obtained, Mr. Ballantyne having shown that more than five per cent. is obtained in summer from milk than cream.

CHYLE. The milky fluid resulting from digestion. It is almost identical with milk, and owes its white colour to fat suspended in it. The chyle is carried directly into the veins, and serves to repair the blood employed in maintaining the functions of the body. It is alkaline, and contains albumen and fibrin.

CHYLIFICATION. The production of chyle.

CHYME. The solid parts resulting from digestion, which are first white from admixture with chyle, but ultimately become converted into feculent matter. Chyme is slightly acid, from the presence of lactic acid

CICADA. A genus of insects related to the grasshopper and locust, but inhabiting trees; they make a shrill sound. The dry fly of the South is a species (*C. canicularis*). The cicadæ, by puncturing trees and allowing their sap to exude, do much harm; the *C. orni* produces, in this way, the *manna* of the druggists, by wounding the *Fraxinus ornus*, or manna ash-tree. The seventeen-year locust is the *C. septendecim*.

CICATRIX. The scab of a wound in the act of healing.

CICHORIUM. The generic name of a number of composite plants, of which the *C. intybus* is chicory or succory, and *C. endiva*, endive.

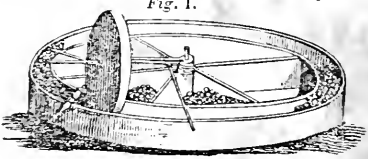
CIDER. The fermented juice of apples. The Harrison, Newark Sweeting, Hugh's Virginia Crab, and Granniwinkle are the best cider apples; but any fruit serves that is well flavoured and becomes sweet in the pomace. The apples should be ripe, mashed well in a mortar or mill, and the crushed mass kept until thoroughly sweet (from two to six days); it is then placed in a frame surrounded by straw and put under the press. The juice should be put in barrels, in a cool place, to ferment, and as soon as the feculent matter (pulp) contained in it has overflown (about four days), it should be racked or decanted into a clean cask furnished with a vent peg, bunged up, and placed in a cool cellar. It is advisable to secure the decanted cider from becoming sour and running into vinegar, by burning a little sulphur in the new cask immediately before pouring in. The liquor will be fit for bottling in February. Some persons add sugar and spirits to the cider, but they tend only to increase its intoxicating effects. Old cider, made without such addition, contains from seven to nine per cent of alcohol.

By allowing the juice to remain in the first cask it speedily becomes sour, and vinegar is rapidly formed as long as air finds access. As soon as the juice is intensely sour, bung up the barrel, or the *acetic acid* evaporates, and only a flat water is left behind.

The refuse pomace is sometimes moistened with water, and pressed again to form water cider. It is eaten by hogs and cows while fresh; or, if in great excess, may be carried to the farm-yard to add to the manure heap. Every part of the apparatus must be kept clean by washing with hot water and scrubbing.

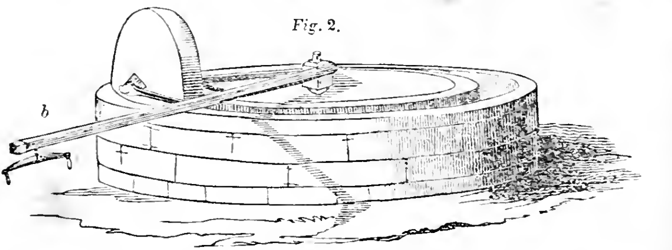
CIDER MILL. Several contrivances are used for the purpose of crushing the apples; a large trunk of a tree, hollowed, serves for a small family, the fruit being beaten by a wooden beetle. The following are more effective mills: *Fig.* 1 presents compartments for varieties of ap-

Fig. 1.



ple; the large millstone, *a*, is drawn around in the groove and crushes every particle of fruit. *Fig.* 2 is a mill of similar construction, but more substantial; *b* is the swinging tree.

Fig. 2.



Another mill, figured under the article *Crushers*, is also used for this purpose. The mill (*Fig.* 2) above would be of great service on the farm to crush corn, roots, bones, charcoal, &c., as well as fruit.

CILIA (from *cilium, the eyelash*). Minute hairs on the margins of leaves, angles of the bodies of insects, &c. *Ciliate* is a derivative.

CIMEX. The general term for insects resembling the bedbug.

CINEREOUS (from *cinis, ash*). Ash coloured.

CINNAMON *Laurus cinnamomum.* This is a small tree, from twenty to thirty feet high, indigenous to Ceylon and the Eastern islands, but cultivated in Cayenne, Egypt, and Brazil. The spice consists of the inner bark of the branches; its flavour is due to an essential oil easily distilled.

CINQUEFOIL. Several species of *Potentilla* with yellow flowers are so called. They are weeds, the roots of which are astringent.

CIRCINNATE. In botany, the manner in which the buds of ferns and some other plants are folded, resembling a crosier.

CIRCULATION. In physiology, the route which the fluids or blood of animals and plants take through the system. It differs with the species of animals, but is nearly uniform in the highest classes.

The circulation of the blood in man and quadrupeds may be said to commence on the right side of the heart, from whence it is driven along the *pulmonary arteries* into the structure of the lungs; being here changed by the action of air, the bright crimson blood is conveyed by the *pulmonary veins* into the left side of the heart, and thence driven by its contraction along the aorta and throughout the body in the system of vessels called arteries. The arterial blood ultimately reaching the skin and membranes, moves through them and becomes of a dark colour; in this state it enters the *veins*, and is conveyed back to the heart again to pass through the same course. The circulation in the lungs is termed the lesser or pulmonic circulation; that through the body, the systemic circulation. The object of this movement is to supply every part with its proper nourishment. The force which accomplishes it is the chemical action taking place in the minute or *capillary* vessels. See *Dr. Draper's work on Vegetable Chemistry.*

CIRCULATION IN PLANTS. Fluid entering the roots of plants rises by capillary action along the cellular tissue or new wood in trees, and diffuses itself over the leaves; here a chemical change occurs, and it is driven along the under side of the leaf to the space between the bark and new wood, where the changed fluid or *sap* diffuses itself and supplies the young buds, and also descends to the roots, forming new wood and rootlets in its passage. The force producing this circulation is, like the former, due to chemical changes in a great measure.

CIRRUS. A tendril.

CITRIC ACID. The sour principle of lemons. See *Acids.*

CITRON. A variety of lemon, the fruit of which is much larger and with a thicker rind, used for preserving; the pulp is less, and acid as in the lemon.

CITRUS. The generic name of the orange, lemon, and lime tree.

CLARIFICATION. The process of clearing or refining fluids, by which they are freed from sediment. The white of egg, the clear portions of blood, clay, and charcoal powder are the best clarifiers.

CLARY. A species of sage (*Salvia sclarea*). It is seldom cultivated in the United States, being inferior to that aromatic herb.

CLASPERS. Tendrils.

CLASS. A general division of natural objects.

CLAVATE (from *clava, a club*). Club-shaped. A descriptive term in botany.

CLAVICLE. The collar bone.

CLAY. The earth which is formed from the decomposition of slates, shales, and minerals containing much alumina. It is a hydrated silicate of alumina, usually coloured red or blue by metals, but sometimes, as in pipe clay and porcelain clay, of its natural white or gray colour. It is very plastic, adhesive, and tenacious of water, so that in soils containing seventy per cent. it is almost impossible to produce a good tillage. It also possesses the property of forming feeble combinations with the ammonia of the air or soil. Clay soils, when manageable, are usually fertile, from the presence of other minerals occurring in them, so that in practice it is customary to value soils by the proportion of this earth.

Chemically, the alumina is a feeble base, uniting with acids, and is found as a phosphate and sulphate, as well as silicate. Clay can hardly be said to furnish food to plants directly, but is of consequence in giving texture and absorbency to soils.

CLAY, BURNED. See *Clay Soils* and *Turf*.

CLAYING LANDS. This is the spreading of clay over soils which are too sandy. It is an important remedy for loose lands; but the expense is too heavy to justify the practice, except in garden culture. The clay should be carried on in the fall, to mellow during winter; 100 or more loads to the acre will be necessary for a good result: the addition is permanent. If marl can be obtained, it is very preferable.

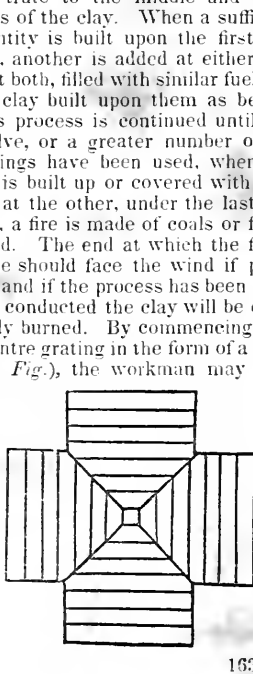
CLAY SOILS. A clay soil consists of a large proportion of alumina united to silica of various degrees of fineness. When the sand is very fine, and intimately mixed with the alumina, the clay, although stiff in appearance, is fertile in proportion to the humus which it contains, or which is artificially added to it. It then forms that class of rich wheat soils which produce many successive abundant crops without change or manure. It has a strong affinity for water, which prevents the plants that grow in it being injured by drought; and it has a sufficient degree of porousness to allow superfluous moisture to percolate without making it too soft. All that is required for such a soil is a porous substratum of rock or gravel; and where this is not the case, sufficient under-drains must be made to produce the same effect. Clay soils are of a compact nature, which retains the water; hence they require expensive draining and manuring to render them productive. This has made lighter soils, which are more easily worked, to be generally preferred, although naturally less adapted to the growth of wheat; and the mode of cultivation of the light soils has advanced more rapidly towards perfection than that of the clays; yet the latter will undoubtedly repay the outlay best when once they are brought to a certain state of improvement. When clay soils are well drained, and when the effect of noxious salts has been removed by liming, burning, and frequent stirring, it will be found that a much smaller quantity of manure will produce a more certain return in grass or corn than on any light soil. The great difficulty is to choose the time when stiff clays are to be worked; and here it may be observed that ploughing sometimes does more harm than good. When clay is wet, especially in the beginning of summer, and it is ploughed in the regular process of fallowing, the tough, moist slice cut out by the plough is set on edge, and the sun bakes it into a hard mass like brick. In this state it is not improved by exposure to the air, which cannot penetrate this hard substance. It would be much better to plough out deep water-furrows with a plough made on purpose, and wait until the moisture is reduced by gradual percolation and evaporation, so that the plough should raise a slice ready to break and crumble as it is turned over. This should be done immediately before winter, and then the frost will so divide and mellow the soil that, provided it be kept free from superfluous water by under-drains and water-furrows, it will have the appearance of the finest mould when worked with the harrows in spring. To plough it again would be to spoil all. It should have received the necessary manuring in autumn, and be ready for the seed to be sown on this pulverized surface. The horses which draw the harrows or the sowing machines should be made to walk in the furrows, which should afterward be deepened out with a plough constructed for the purpose. A free course and outlet should be formed for all surface water; for no maxim is more true than this, that stiff clays are never injured by a continuance of dry weather, unless they were in a wet state immediately before. The dryest clay contains sufficient water to supply the roots of plants for a long time; but wet clay, in drying and shrinking, destroys the texture of the roots by mechanical pressure. This may be of use when weeds are to be eradicated, and in that case a different mode of proceeding may be recommended; but when good seed is sown the clay should be in such a state as to crumble under the harrows. Experience has taught the ploughman that clay soils should be laid in round lands or stitches; and much of the produce of a field depends on the skill with which this is done. It is not only the surface which should lie in a rounded form, but the bottoms of the furrows should lie in a regular curve, without small ridges or inequalities between them, so that, when heavy rains penetrate through the whole thickness which the plough has raised, the water may find its way into the intervening furrows without being retained by the small ridges left by an unskilful ploughman. The slightest inclination of the plough to either side makes an inclination in the bottom of the furrow. An inequality in the depth does the same. The usual method is to increase the depth of the ploughing from the crown of the stitch to the outer furrow. If the land has been cross-ploughed or dragged level before the last ploughing, this may answer the purpose; but if the stitches are only reversed, and the centre of the new stitch is to be where the water-furrow was before, it requires twice ploughing to bring the stitch to its proper form; and this is not always done, for fear of treading the land too much. Hence it is always preferable, where it can be done, to lay the land flat by cross-ploughing and harrowing before it is raised in stitches. The narrower the stitches are the dryer the land will lie. The most convenient width is five bouts, as it is called, that is, five furrows on each side of the centre, which, allowing nine inches for each furrow, makes seven and a half feet, leaving eighteen inches for a water furrow, which is deepened into a narrow channel in the middle.

We have been thus particular in describing the management of clay land, because it seems not so generally understood, and there is great room for improvement in the common modes of cultivation. Fallowing for wheat is the old system on clay soils, and continues to be so in nine farms out of ten; but it often happens that, in a wet season, the whole advantage of the repeated ploughings is entirely lost: the land sown with wheat is neither enriched nor improved by all the tillage bestowed upon it, and it is as full of weeds as it was when first broken up from the preceding stubble. The better system is to clean the land well in summer, after it has borne a crop, and to lay it up high and dry for the winter, having given it the proper liming; to sow it with oats and grass seeds in spring, keep it in grass as long as is convenient, and break it up in autumn. Wheat may then be sown; or it may have the benefit of another winter's frost, and corn may be drilled in spring. Clay land will bear a repetition of the same crops much oftener than lighter lands; but every scientific agriculturist knows the advantage of varying the produce as much as possible, making plants of different families succeed each other. The cereal grasses are of one family, which is the reason why wheat, barley, oats, rye grass, &c., do not succeed so well after each other as after leguminous plants or clover, and that turnips, besides cleaning the land by the repeated hoeings given them, are so good a preparation for corn. A good rotation for stiff clays is yet a desideratum in agriculture; and although we will not affirm that fallows can be entirely dispensed with, we are persuaded that they might be separated by much larger intervals than is usually done; and if advantage is taken of early seasons, most lands may be kept clean by what is called a bastard fallow immediately after harvest, without losing a crop. We will go farther, and assert that, instead of three crops in four years, which is the common method, and an improvement on the old system of two crops and a fallow, five might easily be obtained, especially if clovers are considered as crops. For example: 1. Oats or barley; 2. Clover; 3. Wheat; 4. Trifolium cut in May, and succeeded by spring rye, cabbages, or potatoes. At all events, the trifolium or winter rye may always be had in the year in which the land is to be cleaned by repeated ploughings, as they may be cut early in summer, and leave ample time for the operations.

The most profitable management of a stiff, wet clay soil, after thorough draining it, is to cultivate it on the convertible system, that is, to have it three years in grass and three years under the plough, unless a permanent and good sward can be obtained upon it, in which case it will give the surest return by remaining in grass. A preliminary course of cropping, with ample manuring, will so much improve the texture of the surface that a much better herbage will grow upon it; and when this is well established, it may be left so until it degenerates.

The effect of burned clay as a manure has been highly extolled, and not without some reason in particular situations. Clay by burning alters its nature: it becomes insoluble in water, and loses its attraction for it; it then resembles silicious sand, and may greatly improve a very strong, retentive clay, tempering it and rendering it more porous. To burn clay, it is dug out in lumps and dried; heaps are made of these at regular distances in a field, with a small cavity in the centre, into which dry brushwood is introduced. This being lighted, the fire is allowed to burn very slowly, and the smoke kept in by adding a sod wherever it bursts out. When the heap is once burning, more clay may be added, even without being dry, and the combustion goes on without other fuel. It must be so managed as to bake the clay without heating it too much; and when the heaps are cooled and opened, the whole should appear pulverized, and of a red colour if oxide of iron exists in the soil. A coat two or three inches thick spread over a field, and ploughed in, will greatly improve its texture; but sufficient animal or vegetable manure must be added to make it fertile.

An improved method of burning clay has been adopted in Northumberland. Instead of building a kiln, gratings or arches of cast iron are used to form a vault or funnel for the fuel, and over this funnel the clay is built. The grated arches are made about two feet and a half long, two feet diameter, and about fourteen inches high. One grating is to be filled with brush-wood, stubble, or any other cheap fuel, and the clay, as it is dug, built upon it to a convenient height, leaving small vacancies, or boring holes, to allow the heat to penetrate to the middle and outer parts of the clay. When a sufficient quantity is built upon the first grating, another is added at either end, or at both, filled with similar fuel, and the clay built upon them as before. This process is continued until ten, twelve, or a greater number of the gratings have been used, when one end is built up or covered with clay, and at the other, under the last grating, a fire is made of coals or fagot-wood. The end at which the fire is made should face the wind if possible, and if the process has been properly conducted the clay will be effectually burned. By commencing with a centre grating in the form of a cross (see *Fig.*), the workman may build



from four ends in the place of two; this contrivance will afford a facility in the work, and have a draft of wind at two entrances.

CLEANING. The after-birth of cows, ewes, &c.

CLEARING LANDS. The removal of obstructions to tillage. Much information on this subject will be found in the article *Barren Lands.* The heavy operation is the removal of trees. Two methods are in common use: either to cut a ring of bark and wood out around the trunk, at a foot or two from the ground, and kill the tree, or to cut it down altogether during the early summer, and leave the trunk to dry on the ground. In the first case, grasses, and, indeed, corn can be cultivated among the dead trees, and thus the land is made to produce sooner; but there is risk from the fall of limbs. The dead forest can be burned during summer, the ashes serving to enrich the land for some time. When the trees are felled they are divided into lengths of twelve feet or more, and drawn out of the cleared space, or split and burned, a suitable amount of fence-rails being obtained. In both these operations the stumps remain to disfigure the land; it has therefore been proposed to draw the trees down by a strong chain made fast to their upper limbs, and pulled by oxen or a windlass. This will scarcely answer with large trees, unless the roots are cut through by an axe. The cultivation of cleared lands is necessarily very imperfect; corn, tobacco, hemp, and cotton are found the best crops.

CLEAVAGE OF MINERALS. Minerals which have a regular crystalline form can only be split or cleaved with ease in planes corresponding to their sides; hence, to discover the shape of the crystal, the mineral is split.

CLEFT GRAFTING. See *Grafting.*

CLEFTS. In farriery, cracks in the heels of horses.

CLEVIS. The draught iron of the plough.

CLIMATE. The temperature and liability to winds, rain, &c., of any place. Those places always enjoy the mildest climates which are situated near seas, lakes, or large bodies of water; they also receive most rain. Climate exerts the most important effects on plants, so that they refuse to grow at places very remote from their original stations; but by long-continued attention, and the use of seeds obtained from the highest limits, a few have been naturalized even far north. One very interesting result takes place in the cultivation of plants in the extreme limits of their zone. They usually bear fruit much sooner (in annuals), and the fruit is increased in delicacy and pulp. This is true of staple crops also, which are better in their most northern positions than in the original place of growth, as cotton, hemp, and flax. But the rule does not apply to oily or saccharine plants; and many annuals become perennials in northern positions.

CLINANTHIUM. The flat surface in which many composite flowers are arranged, as the sunflower.

CLINKSTONE. A hard, slaty mineral.

CLOACA. The common cavity in which the intestines and urinary apparatus terminate in fish, birds, reptiles, and some larger animals.

CLOD-CRUSHERS. See *Roller.*

CLOTHING HORSES. It keeps the coat fine, and in northern latitudes is very useful in preserving health.

CLOUD. A mass of vapour, similar to a fog, suspended in the air. The height varies with the density, but seldom exceeds two miles. Clouds differ in form, transparency, &c., according to the amount of vapour of water they contain and the wind which drives them. Meteorologists divide them into three classes: 1st. *Cirrus*, which is a light, branching cloud; 2d. *Cumulus*, a conical mass of clouds; 3d. *Stratus*, which consists of horizontal layers. Every variety occurs, compounded of these primary forms.

Clouds owe their origin to a par

tial condensation of the vapour of water, which air naturally contains. The condensation is produced by cold and the operation of winds blowing in directions contrary to one another.

CLOUTED CREAM. The clouted cream of Devonshire is a well-known delicacy. It is made by heating the milk on the hearth, or by means of a stove, to a degree a little below the boiling-point, when the clouted cream rises to the top like a thick scum, and is taken off when cooled. This cream being merely stirred briskly with the hand or a stick, is converted into butter. It is universally admitted that the butter thus produced is inferior to that which is made from the cream which has risen slowly and spontaneously, and in all the largest and best dairies in the vale of Honiton the cream is never clouted, except to be eaten in that state as a luxury.

CLOVER. A name given to different species of trifolium. Dutch clover is *T. repens*;(*b*) purple clover is *T. pratense*;(*a*) cow grass, or perennial clover, is *T. medium*.(*d*)

Its abundant produce, its destruc-

tion of annual weeds, which it smothers by its broad foliage, and especially the beauty of the wheat sown after it, recommend it as an indispensable part of an improved rotation of crops. There are various kinds of clover, which all go under the botanical name of trifolium, from the three leaves which grow together, or, rather, the form of the leaf, which has three heart-shaped parts. They are annual, biennial, or perennial plants. The annual clovers, with the exception of the *Trifolium incarnatum* (*Trèfle incarnat* or *farouche*),(*c*) introduced from the south of France, are not so generally cultivated as the biennial, which produces a greater crop, and being sown along with the spring grain, comes up the first year under its shade, and gives two full crops in the second. In good land it will sometimes stand another year, but it falls off in quantity; and unless other artificial grasses or perennial clovers have been sown among it, to fill up the places where the biennial clover has failed, it is seldom profitable to allow it to remain on the ground more than one year after that in which it is sown. It should be ploughed in in the fall in clay lands for a spring crop, but if fallowed early, wheat can be grown on the fresh ley.

The most approved variety of the

biennial clovers is the common red or broad clover (*Trifolium pratense*), which is usually sown with barley or oats, or sometimes among wheat or rye in spring, at the rate of ten to thirteen pounds of clover seed. Clover is often perennial. The time for cutting is when the flowers are just expanded; the hay is more abundant and better by upward of ten per cent. The first crop is generally mown and made into hay. In this process great care is taken not to break off the tender leaves of the plant in drying; the swarth is not shaken out as is done with meadow grass, but merely turned over; and if the clover can be dried and put in a stack without any shaking, it is so much the more valuable. When clover is soaked with rain, no hope of an improvement in the stack must induce the farmer to carry it together so long as the least moisture remains. If it be allowed to stay in the field till perfectly dry, even when it has been soaked repeatedly and is nearly black, and is then trod hard in a rick with a sprinkling of salt over each layer, it will be readily eaten by cattle in winter, and be far more nutritious than that which, having been stacked in a moist state, will infallibly come out musty. A very good method in those seasons when a continuance of dry weather cannot be reckoned upon—particularly when the second crop is cut in September—is to take advantage of two or three dry days to cut the clover, and turn it as soon as the dew is completely dried off the upper side; the next day do the same, and in the evening carry the green, dry clover and lay it in alternate layers with sweet straw, so as to form a moderately-sized stack. A fermentation will soon arise, but the dry straw will prevent all danger from too much heating, and, acquiring the flavour of the clover, will be eaten with avidity by the cattle. To those who make clover hay for the use of their own stock in winter, we recommend this as preferable to the common method, even when there is less danger from the weather. The process of curing by sweating is very well adapted to clover.

It is usual to sow timothy in a small proportion with clover seed, especially where clover, having been often repeated on the same land, is apt to fail.

The most profitable use of clover is to cut it green for horses and cattle. With a little management, green food may be given to all the stock from the first day of April to October.

The land which has borne clover is in a very good state for producing corn or wheat. In the regular Norfolk rotation, clover should recur every fourth year: but after a few rotations this is found to be too quick a recurrence, and other grass seeds or pulse are substituted. The Flemish do not sow clover again on the same ground sooner than in eight or ten years.

The white or Dutch clover (*Trifolium repens*) is a perennial, which grows rapidly, and forms excellent pasture; but its bulk is not sufficient to make it profitable to mow for hay. It is excellent for sheep, which thrive well upon it. A light, calcareous soil is best adapted for white clover, but it also grows well on heavy land, provided the bottom be sound and dry.

Another perennial clover, called cow grass (*Trifolium medium*), is found in all rich meadows: it is often sown in conjunction with the white clover in laying down arable land to grass. The lesser yellow trefoil (*Trifolium minus*) and the hop trefoil (*Trifolium procumbens*) are also valuable varieties found in good pastures.

The only annual clover which is cultivated is the French clover (*Trifolium incarnatum*) mentioned before. It is a most valuable addition to the plants usually sown for fodder, from the short time in which it arrives at perfection if sown in spring; so that, where clover has failed, this may be sown to fill up the bare places. Its principal use is to raise very early food for ewes and lambs, which it does with very little trouble or expense. Immediately after harvest the stubble is scarified and harrowed, so as to raise a mould ; the trifolium is sown at the rate of sixteen to twenty pounds per acre, and well rolled in. It springs up and stands the winter well, and with the first genial weather in spring it grows rapidly. It makes excellent hay, and what is left produces seed most abundantly in the end of May or beginning of June, being off the ground in good time to plough the land and clean it for turnips. It is far superior to stubble turnips as an intervening crop, and more rapid in its growth than tares. On light land a crop of buckwheat is readily obtained after it. It has the property of smothering annual weeds by its rapid growth, and for this reason is not so well adapted for sowing with other crops. The Italian rye grass (*Lolium perenne*) may be sown with it, and will grow as rapidly. After the trifolium has been cut, this will continue and give an excellent second crop

In France and in the United States plaster is considered as a specific manure for clover. It is sown by hand over the plant in spring, and in some situations the advantage is evident, in others scarcely observable. The quantity used is about one bushel to the acre.

On good land an acre of clover will produce as much as three tons and a half of dry hay ; that is, two tons the first cutting, and one and a half the second. Greater crops are obtained on very highly manured land. The value of a ton of clover hay to feed horses with is about fifteen or twenty per cent. more than good meadow hay.

When clover is intended to be left to ripen its seeds, it should be mown early, or fed off by sheep in May. The first crop is seldom free from various seeds of other plants which rise among the clover : by feeding it down or mowing it these are destroyed, and the clover, which grows more rapidly than most other plants, rises again without any mixture of weeds. When the blossom is thoroughly withered, and the seed is nearly ripe, the clover is mown and left to dry on the ground without much shaking. In very dry weather it may be housed or stacked in a week ; but the process is much retarded by showers. It is well known that the subsequent stock suffers if the clover is allowed to stand for seed. As the calyx of the flower of clover envelops the seed closely, it is difficult to separate them. There are various machines for this purpose, one of which consists of two fine-rodded hurdles, made to rub on each other while the heads pass between them. The principal clover mill for separating the seed is by J. Rittenhouse, price sixty dollars. Clover is generally thrashed on the floor, but if the heads, after being separated from the haulm, are put together in a heap and pressed, a slight fermentation takes place, and this makes the calyx brittle, so that it breaks into dust, and the seed comes out readily ; it is then easily cleared by the fan. The yield is four to five bushels the acre.

When the seed is not intended for the market, the trouble of clearing it from the husk may be saved, especially in the *Trifolium incarnatum* It will grow as well when sown with the husk as when cleaned, and it is easy to find the proportion required to be sown in that state by allowing for the weight of the husk.

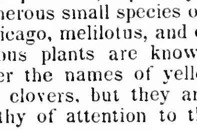
CLOVER, VARIETIES. Numerous plants are more or less cultivated resembling clover, hence some confusion has arisen in the popular names. Thus, the *Chilian clover* is lucern. *Bokhara clover* is sweet clover (*Melilotus major*) ; it is a coarse plant, rising to six and ten feet, but if cut four or five times in the season, when about two feet high, it yields an immense quantity of good herbage for soiling. The seed should be sown in spring in drills eighteen inches apart. It should be kept free from weeds when young, thinned out by the hoe, and cut close to the gronnd. It is perennial, and will stand the winters of Virginia, and probably of Pennsylvania. The mature stems make good hemp when rotted and broken. Two pounds of seed the acre is abundantly enough.

"Mr. James Gowen, who resides at Mount Airy, near Philadelphia, has been much in the practice of keeping up a considerable stock of uncommonly fine cattle, and soiling them in summer upon lucern, rye, and red clover. He has raised patches of the melilotus, and from his observation says, 'there is no grass or plant I have yet seen that affords to me such promise as the sweet-scented or Bokhara clover.' "—(*Cultivator, November*, 1842.)

CLOVER, GIGANTIC. The same as Bokhara clover.

CLOVER, ALSIKE. *Trifolium hybridum.* A supposed hybrid between the white and common red clover. It is very hardy, withstanding the winters of Sweden, perennial, but runs close to the ground, and is only fit for pastures, especially for sheep. Numerous small species of trifolium, medicago, melilotus, and other leguminous plants are known vulgarly under the names of yellow, sweet, &c., clovers, but they are scarcely worthy of attention to the cultivator.

CLOVER, MACHINE FOR GATHERING. A simple contrivance for gathering the seed heads is much used, and is figured below. It is of wood, but the teeth may be made of wrought iron, and the wheels removed with advantage. It is drawn by one horse, and managed by a boy. The hand gatherer (*a*) is used for emptying the barrow, or for collecting pease, beans, &c.



CLOVES. The unexpanded blossoms of an Eastern tree, the *Eugenia caryophyllata.* They contain an oil highly aromatic, and grateful to the stomach in minute quantities. It is a tropical production.

CLUPEA. The generic name of the herring and shad fishes, anchovies, sprats, &c.: most of the species are migratory.

CLUSTER. A bunch. A *raceme* in botany.

COAGULATION. The formation of a solid body of a jelly-like character.

COAL. Numerous varieties exist: that of Pennsylvania and Wales (Eng.) is anthracite, difficult of combustion, producing no flame, but intense heat: it is nearly pure carbon. *Bituminous coal,* such as that of Virginia and Ohio (Liverpool coal), contains hydrogen as well as carbon, and gives off gas and flame in burning. *Wood coal* resembles charred wood, and shows the marks of wood: it produces much light.

All coal is of vegetable origin, being, indeed, the remains of plants and trees. The chief beds of it are arranged in a curved form; hence the term *coal basins.* This variety lies above the old red sandstone, and is covered with sandstones and conglomerates. It is, therefore, a secondary formation, and, according to the New-York geologists, does not exist in this state.

COAL TAR. A tary fluid of a complicated nature, produced during the distillation of bituminous coal for gas. It is a cheap and excellent paint for iron-ware, railings, &c., and has latterly been used on woodwork. It preserves the timber, but it is doubtful whether the colour may not prove injurious by causing warping.

COBBLES. Small round stones.

COCCINELLA. The generic name of the lady-bird insects. *They are of great service* to the farmer and orchardists in destroying plant lice (*Aphides*), on which they prey.

COCCULUS INDICUS. A poisonous Eastern berry used in medicine; it is sometimes employed, to cause intoxication, in beer, or thrown into fish ponds to stupify fish, which can be caught by the hand while suffering from its effects. The poisonous principle is *picrotoxia.*

COCCUM. A dry elastic seed covering.

COCCUS. The bark lice or scale insect family. See *Bark Lice.*

COCCYX. The termination of the spinal column.

COCHINEAL. The *Coccus cacti*, a Mexican insect. The fine article should be of a grayish exterior, and the lines of the body clearly defined. The brilliant scarlet of cochineal is fixed in dyeing by a mordant of alumina and solution of tin, and brightened by cream of tartar.

COCHLEATE (from *cochlea, a shell*). Twisted like some shells.

COCK-CHAFFER. See *Insects.*

COCKLE. The weed *Agrostemma githago*, which grows amid wheat, and whose black seed impair the colour of flour if not well separated by screening. It is an annual, to be destroyed only by a succession of fodder crops cut for soiling before flower, or by clean fallows.

COCK'S-FOOT GRASS. The orchard grass. See *Grasses.*

COCOA GRASS. Dr. Cartwright thus writes in the American Agriculturist:

"There is a repent plant called the cocoa in Louisiana and Mississippi, which, instead of running on the surface of the earth, runs down into it to the depth of four or five feet, and horizontally a little under the surface, mole fashion, and at short intervals throwing up a bunch of thick, coarse grass. A better idea of this plant can be formed by calling it a subterraneous strawberry. It bears nuts under ground the size of strawberries. Their bitter taste distinguishes them from the nut grass, called sweet cocoa. The bitter cocoa grows so fast, that double the number of labourers are required to cultivate the lands infested by it. All those who, ignorant of this pernicious repent, have purchased cocoa lands, have paid dearly for the want of a little practical information, as they are nearly all bankrupt. Many have wisely abandoned their cocoa plantations. No means have been discovered of extirpating this pernicious repent when it once gets fixed in the soil."

It certainly would be exterminated by hoed crops, or long-rooted perennial plants, as clovers. Notwithstanding its vivacious nature, it is a grass of great value to the grazier and sheep raiser. It is sometimes called nut grass.

COCOON. The web which covers the chrysalis of an insect.

CŒLIAC (from κοιλος, *hollow*). Relating to the belly or abdomen.

COFFEE. The berries of the *Coffæa Arabica*, a tropical shrub. The coffee plant thrives between the tropics in situations where the mean and nearly constant temperature is between 22° and 26° C. (71·5° and 80° F.).

Coffee is rarely sown in a nursery; the seeds are made to germinate still surrounded by their natural pulp, and wrapped up in leaves of the banana. The young plants, after seven or eight days of germination, are put into the ground. In the Valley d'Aragua an acre of ground of good quality is generally laid out with about 1040 plants. The coffee plant flourishes in the course of the second year; when left to grow unimpeded, it will attain a height of from 23 to 26 feet, but it is seldom allowed to grow so high, its upward progress being checked by pruning. The planters of Venezuela generally keep it at a height of from five to six feet. The shrub receives the care of the planter during the first two years; the ground must be kept free from weeds, and the growth of parasites must, above all, be prevented. To thrive, the coffee plant requires frequent rains up to the time of flowering. The fruit bears a strong resemblance to a small cherry, and is ripe when it becomes of a red colour, and the pulp is soft and very sweet. As the berries never ripen simultaneously, the coffee harvest takes place at different times, each requiring at least three visits made at intervals of from five to six days. A negro will gather from ten to twelve gallons of fruit in the course of a day.

Two beans are found in the interior of each berry; in order to free these from the pulp which surrounds them, they are passed through a kind of mill, and the coffee is steeped in water for twenty-four hours in order to free it from the mucilaginous matter which adheres to it: it is then dried by being spread out upon a floor under a shed. In the coffee plantations of Venezuela which I visited, I saw them proceed in another way: the berries were exposed to the sun upon a piece of ground somewhat inclined, and spread out to about three inches in thickness; the pulp soon enters into fermentation, and a very distinct vinous odour is exhaled, and the juice altered either flows away or dries up; at the end of a fortnight or three weeks the berries are all dry and shrivelled, and they then undergo two triturations, one to obtain the seeds or beans, the other to detach a thin pellicle which surrounds them. Three bushels of berries will yield from 85 to 90 pounds of marketable coffee.

During the destruction of the sugary matter contained in the pulp of the berry, a considerable quantity of spirit is produced and dissipated. M. Humboldt, struck with the readiness with which the berry of the coffee plant runs into fermentation, expresses his surprise that no one ever thought of obtaining alcohol from it. In an old work, however, I find the following passage: "The inhabitants of Arabia take the skin which surrounds the coffee bean, and prepare it as we do raisins; they form a drink with it for refreshment during the summer."* This vinous liquor appears to enjoy all the exciting properties which are esteemed in the infusion of coffee.

The coffee plant continues to produce to the age of forty to forty-five years; it bears to a considerable extent even in the third year. Some shrubs yield from 17 to 22 pounds of dry coffee beans; but this is a very large quantity. An acre of land in the Valley d'Aragua, planted with about 1040 shrubs, will yield about 940 or 950 pounds, which is at the rate of somewhat less than one pound per shrub.

Coffee contains the same active principle as tea, coffeine, but in less proportion; the researches of different chemists have also shown the presence of a particular acid called coffeic acid, of fatty matters, a volatile oil, a colouring matter, albumen, tannin, and alkaline and earthy salts. —(*Boussingault.*)

COFFEE-TREE. The *Gymnocladus Canadensis.* A leguminous tree, the beans of which have been slightly used for coffee; they are nutritious, but rather sickening, and are said to destroy flies with great certainty when a decoction is exposed in proper places. The foliage of the tree is like that of the black walnut.

The tree often attains 60 feet, and 15 inches diameter; it has few branches, and those thick: its presence is said to indicate the richest soils. The wood is rosy, compact, and as durable as the locust, and like it, containing very little sap wood.

COFFER DAM. In architecture and bridge-building, a case of piling, water-tight, fixed in the bed of a river for the purpose of laying the bottom dry for a space large enough to build the pier on. Coffer dams are formed in various ways, either by a single enclosure or a double one, with clay or chalk rammed in between the two to prevent the water from coming through the sides. They are also made either with piles only, driven close together, and sometimes notched or dovetailed into one another; or, if the water is not very deep, by piles driven at a distance of five or six feet from each other, and grooved in the sides with boards let down between them in the grooves. In order to build in coffer dams, a very good natural bottom of solid earth or clay is required; for though the sides be made water-tight, if the bed of the river be of a loose consistence, the water will ooze up through it in too great a quantity to

* Mem. of the Academy of Inscriptions, vol. xxiii., p. 214.

permit the operations to be carried on. It is almost needless to remark that the sides must be very strong and well braced in the inside to resist the pressure of the ambient water.—(*Hutton's Tracts*, vol. i.)

COFFIN BONE. The bone which lies encircled within a horse's hoof.

COHESION. The force which binds together similar particles: it is supposed to be electrical. The strain which any wood or metal bears is a measure of its cohesion.

"The following is a tabular view of the absolute cohesion of the principal kinds of timber employed in building and carpentry, showing the load which would rend a prism of an inch square, and the length of the prism which, if suspended, would be torn asunder by its own weight:

Teak	12,915 lbs.	— 36,049 feet
Oak	11,880	— 32,900
Sycamore	9,630	— 35,800
Beech	12,225	— 38,940
Ash	14,130	— 42,080
Elm	9,720	— 39,050
Memel fir	9,540	— 40,500
Norway fir	12,346	— 55,500
Larch	12,240	— 42,160

"The metals differ more widely from each other in their cohesive strength than the several species of wood or vegetable fibres. According to the experiments of Mr. George Rennie in 1817, the cohesive power of a rod an inch square of different metals, in pounds avoirdupois, with the corresponding length in feet, is as follows:

Cast steel	134,256 lbs.	— 39,455 feet
Swedish malleable iron	72,064	— 19,740
English ditto	55,872	— 19,740
Cast iron	19,096	— 6,110
Cast copper	19,072	— 5,093
Yellow brass	17,958	— 5,180
Cast tin	4,736	— 1,496
Cast lead	1,824	— 348"

(*Brande's Encycl.*)

COKE. The cinder of bituminous coals after being heated for gas.

COLCHICUM. *Colchicum officinale.* Meadow saffron, a bulbous plant, growing freely in moist, sandy loams. The bulb and seeds are of the highest value as a medicine in gout and rheumatism. In large doses it is poisonous.

COLE. See *Colza.*

COLEOPTERA (from *κολεος, a sheath*, and *πτερον, a wing*). Insects, the outer wings of which are hard or horny, the inner wings being large and very delicate. Borers, lady-birds, curculios, &c., belong to this race. The hard outer wings are called *elytra.*

COLEWORT. See *Cabbage.*

COLIC. In common parlance, an irritation of the stomach or intestines, causing pain, and readily alleviated by a slight purge or by laudanum.

COLLAPSE. A loss of strength.

COLLAR BLADE. The haims.

COLLEY. The Scotch sheep dog.

COLLIQUATIVE. An excessive evacuation, diminishing the strength.

COLLUM. The point where the roots diverge from the stem of plants.

COLLYRIUM. An eye-wash.

COLOCYNTH. The pulp of the *Cucumis colocynth*, a plant similar to the cucumber, bearing round fruit of great bitterness and purgative power. The cultivation is similar to that of melons.

COLON. The large intestines.

COLOPHONY. The dark resin remaining after the distillation of the spirit from rosin.

COLT. A young horse, ass, &c.

COLT'S FOOT. A vile perennial weed.

COLUMBARIUM. A pigeon-house.

COLZA. Two or more varieties of plants of the open cabbage kind (*Brassica arvensis* and *campestris*) are cultivated under this name in Germany and France. They are usually sown in drills, but sometimes broad cast for eating off in the fall. The most common object in the cultivation of colza is the seed, which yields a coarse oil like rape, and is obtained by pressure. The cake is very similar to that from rape, and used like it for fodder and manure. The treatment is precisely similar to *rape*, which see.

COMA (from *κεω, to lie down*). A propensity to sleep, amounting to a disease or stupidity. *Comatose* is a derivative.

COMBINATION. In chemistry, the chemical union of atoms, whereby the sensible properties of the combining parts are altered. It takes place in mathematical proportions. See *Atom*.

COMBUSTION. Burning. The chemical change of a body, attended with heat or light. For combustion, the body must be surrounded with a medium which enters, in part, into the change, such as oxygen, chlorine, &c.

COMFREY. The *Symphytum officinale*, a rough perennial plant, with coarse, rough leaves and large roots.

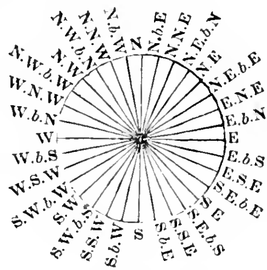
The American Agriculturist thus writes:

"We learn by the Portsmouth Journal that Mr. Robinson is of opinion, from an imperfect experiment made by him on a small patch of ground, that he will be able next year to gather, at two cuttings, eight tons of leaves of the comfrey root to the acre, which, he says, is excellent food for stock. The root is considered very nutritious for man or beast; and Mr. Rich, of Troy, N. H., asserts that it can be harvested every two or three years, and will yield over 2000 bushels per acre. We should think it advisable to try the experiment of a rod or two square of growing comfrey in this vicinity. It is cultivated by transplanting the roots, which grow wild in the fields, to any ground deep ploughed and well pulverized."

COMMISSURE. In anatomy, a junction or union.

COMOSE. Ending in a tuft or brush, like the top of a tree.

COMPASS. An instrument used by mariners and surveyors to obtain the bearing of any place. The essential part is a magnetic needle, which plays over a card marked into the points of the compass. The following figure gives the full divisions: N signifies north, S south, E east, W west, and *b* by or towards.



COMPOSITÆ. Plants like the sunflower, dandelion, lettuce, &c., the flowers of which are grouped together on a flattish surface. They are very numerous, and form the *Syngenesia* of Linnæus. Few are cultivated; most are valueless weeds; but chamomile, wormwood, and a few others yield bitter medicines. Their ashes abound in potash.

COMPOST. Any compound of manures, usually of vegetable matter for the most part. See *Peat*, *Lime*, *Vegetable Matter*, &c.

COMPRESSIBILITY. This quality depends on the natural pores of bodies, which enable the solid parts to approach nearer under great force.

CONCAVE. Having a hollowed surface. Concave surfaces in mirrors produce a magnifying effect, and condense heat and light.

CONCEPTACLES. The seed cases of ferns, lichens, &c.

CONCHOID (from *κογχη, a shell*). Like a shell. The name of a curve.

CONCRETE (from *concrescere, to coalesce in one mass*). In architecture and engineering, a mass composed of stone chippings or ballast cemented together through the medium of lime and sand, usually employed in making foundations where the soil is of itself too light or boggy, or otherwise insufficient for the reception of the walls. The essential quality of concrete seems to be, that the materials used should be of small dimensions, so that the cementing medium may act in every direction round them, and that the latter should on no account be more in quantity than is necessary for that purpose. Architects and engineers have much varied the proportions of lime and sand used. If the lime, which should be fresh and ground to powder, be good stone lime, it will bear three or four times its measure by bulk of sand. These and the ballast or gallots, as the stone chippings are called, should be thoroughly turned over and mixed together. If the foundations be wet, the mixture will want very little if any water; indeed, sometimes the ballast only is wetted, and then covered over with the lime and sand. It is then filled into the barrows, and run on to be dropped from a stage into the foundations. This latter operation should be performed at as great a height as possible above the level of the trench, in order that the whole of the different particles of the composition may be compressed together so as to occupy the least possible space. The stones employed should not exceed the size of a common hen's egg. The mass very quickly sets and becomes extremely hard. On the top of it, which is kept as level as possible, a tier of stone landings is laid, and very often throughout the length a chain of timber is buried in the footings, whose durability is requisite only while the work is settling; over the landings and timber thus laid, the latter, it is to be observed, occupying but a very small portion of the thickness of the footings, and quite buried in them, the walls are carried up.—(See *Davy on Artificial Foundations*, and *Totten on Mortars, Cements*, &c.)

CONDENSATION. The rendering a body more dense, most commonly applied to the conversion of vapour into the fluid form.

CONDENSER. Any machine by which the compression of gas, &c., can be effected.

CONDITION. In horsemanship, the health and good appearance of a horse or other animal.

CONDUCTOR. In physics, any substance which allows the passage of heat, light, or electricity is said to conduct it.

CONDYLE (from *κονδυ, a cup*). The rounded ends of the long bones.

CONFERVA. An extensive family of small water weeds, forming the green slime on stagnant waters. They nourish innumerable insects and animalcules.

CONGELATION. The act of passing into the state of ice or other solid forms from the fluid.

CONGESTION. In farriery and medicine, an increased accumulation of blood or other fluid in any part. It is to be relieved by bleeding, cupping, leeches, or counter irritation.

CONGLOMERATE. In geology, a compound stony mass containing pebbles, &c., cemented together by iron, calcareous or other matter.

CONIC. Relating to a cone, smaller at one end than the other.

CONIFERÆ. Trees bearing cones, as the pines, firs, cedars, &c. The wood of all is useful, and they grow usually upon poor soils.

CONIROSTERS. A tribe of birds with strong conical bills, as crows and finches.

CONIUM. The genus containing *hemlock*, which see.

CONNIVENS. In botany, any covering or arrangement by which the parts of a plant or flower are hidden; as the flowers of the fig by the connivent receptacle.

CONSERVATORY. In horticulture, a glazed structure, in which exotic trees and shrubs are grown in a bed or floor of soil. It is distinguished from an orangery by its having a glazed roof, while that of the latter is opaque; and from a greenhouse, by the plants being planted in the free soil, and thus growing up from the floor, while in the greenhouse the plants are grown in pots placed on shelves, or on a stage or series of shelves rising one above another. Above a century ago, for example, in the time of Evelyn, the term conservatory was applied to those garden buildings now called orangeries, and in modern horticulture employed only for the preservation of exotic plants, such as orange-trees, &c., which are in a dormant state during winter. The greenhouse and the modern conservatory were then not in existence. They are exclusively employed for the preservation of plants which are in a growing state during the winter. The largest conservatory in the world, at the present time (1841), is that erected at Chatsworth in Derbyshire, for palms and other tropical plants, which covers above an acre of ground, and is sixty feet high.—(*Brande's Encyclopedia.*)

CONSTIPATION. Costiveness, want of regular evacuations from the bowels.

CONSTITUTION. The general strength and liability to disease of any person or animal.

CONSTRICTOR. Any muscle which has the power of closing the openings of the body.

CONTRACTION OF THE HOOF. In farriery, a distorted state of the horny substance of the hoof in cattle, producing all the mischiefs of unnatural and irregular pressure on the soft parts contained in it, and, consequently, a degree of lameness which can only be cured by removing the cause. Contraction of the hoof rarely happens, however, except to those animals whose hoofs, for the convenience of labour, are shod.—(*Johnson.*)

CONVERTIBLE HUSBANDRY, or MIXED HUSBANDRY. A term implying frequent change in the same field from tillage crops to grass, and from grass back to tillage crops; an alternation of wheat, rye, &c., with root and grass crops.

CONVOLVULACEÆ. A family of plants, including the bind weed, sweet potato, and jalap. The stems are commonly twining, and the large roots purgative; the flowers are often beautiful and large.

CONVULSIONS. An unnatural action of the muscular system produced by a derangement of nervous power. Staggering is a convulsion originating in an excess of blood being diverted to the head, and is relieved by bleeding; the use of hot baths to the lower extremities is also useful. Worms frequently produce convulsions.

COOLER. The large vats of brewers are so called.

COOMB. A measure of four bushels.

COOP. A cage for poultry, of basket-work or laths.

COPAL. A resinous body which forms an excellent varnish when dissolved in linseed oil, and mixed with turpentine.

COPING. The top course of a wall, usually of stone, and wider than the wall, to save it from rain.

COPPER. A red ductile metal, remarkable for its conducting power. The sulphate, or blue vitriol, is used as a caustic in farriery, in dyeing, and sometimes as a steep to kill insects and parasites, &c., on wheat and grain. A solution of blue vitriol, at the rate of one ounce to enough water to thoroughly soak a bushel of wheat, is esteemed the most certain preventive to smut, rust, and mildew, and has been long used in Germany, Switzerland, and the northeast of France. The black oxide is of great service in analysis.

COPPERAS. Green vitriol, sulphate of iron. Blue copperas is sulphate of copper, or blue stone.

COPPICE. A young wood. Wood cut every few years.

COPROLITE (from κοπρος, *excrement*, and λιθος, *a stone*). The fossils resembling cones, which are found in the ancient calcareous formations, and shown by Professor Buckland to be the petrified excrements of former animals. They have been discovered in the green sand of

New-Jersey. Liebig called the attention of farmers to coprolites as a manure containing sixteen to twenty per cent. of bone earth.

CORALS. The calcareous basis of some marine animals. Coral sand has been used freely in France in the same way and with similar effects as marl. It may contain two per cent. of bone earth.

CORDATE. In botany, heart-shaped. Like the heart on playing cards.

CORD. A measure for wood, equal to four feet high and wide, and eight feet long.

CORD GRASSES. Coarse, salt-marsh grasses, of the genus *Spartina*.

CORDIAL. A stimulating, stomachic medicine.

COREOPSIS. A yellow composite garden flower, the fresh flowers of which yield a yellow dye.

CORIANDER. The *Coriandrium sativum*, an umbelliferous plant cultivated for its aromatic seeds, which are used in confectionery and medicine. The soil must be dry. "The sowings are generally performed in *April* in drills eight inches apart, and half an inch deep; the plants to remain where sown. The only cultivation required is to thin them to eight inches' distance, and to have them kept clear of weeds throughout their growth. They will perfect their seed in early autumn, being in flower during June."

CORK. The bark of the Spanish oak, *Alcornoque* (*Quercus suber*). It would flourish wherever the live oak grows, but requires a dry granitic soil, and might be made a source of great profit to the Southern States. The tree is evergreen, not very large (sixty-five feet), yields fine sweet acorns, and begins to supply good cork at forty years. The cork is stripped every eight or ten years afterward. It is taken in July, a perpendicular cut being made the length of the trunk, and a circular one above and below, down to the new bark, but not into the young wood. The tree of 100 years furnishes from 200 to 400 pounds of cork. The young oak plantations are set with vines, which last for twenty-five years.

CORMUS. The solid swelling beneath the stem of some plants. See *Bulb*.

CORN. In Europe, wheat, or a mixture of pease, beans, and oats.

CORN, BROOM. See *Broom Corn*.

CORN, INDIAN. *Zea mays*. An annual cereal plant of great importance to American agriculture.

Varieties.—These may be divided into two classes: 1st. Table corn. 2d. Field corn.

The esteemed table corns are, Early Golden Sioux, Canadian, Early Tuscarora, and Sweet Corn. The White Hominy and Dutton also answer for late sorts when green.

Field Corn. — The varieties are very numerous, and designated by the number of rows, the colour and shape of the grain. The clear white or yellow is always preferred; a long heavy grain, large ear, small cob, and those of early maturity. The favourite northern varieties are of the Sioux kind, of a yellow gourd-seed grain, the Dutton, and several kinds of flint and Canadian corn. In the Middle States the yellow gourd-seed and Virginia white gourd-seed, of twenty-four to thirty-six rows, are chiefly cultivated.

Other Varieties.—A small corn (*Zea caragua*) is used for parching; it is called pop corn and Valparaiso.

Baden, or *Tree Corn*.—This created much attention at first, and is worthy of cultivation, but with that care which was taken in its production. Mr. Baden's account is from the New-England Farmer, and is a lesson on the improvement of any variety of grain or plant.

"I have the pleasure to say that I have brought this corn to its high state of perfection by carefully selecting the best seed in the field for a long course of years, having especial reference to those stalks which produced the most ears. When the corn was husked, I made a re-selection, taking only that which appeared sound and fully ripe, having a regard to the deepest and best colour, as well as to.

the size of the cob. In the spring, before shelling the corn, I examined it again, and selected that which was the best in all respects. In shelling the corn, I omitted to take the irregular kernels at both the large and small ends. I have carefully followed this mode of selecting seed corn for twenty-three years, and still continue to do so. When I first commenced, it was with a common kind of corn, for there was no other in this part of the country. If any other person undertook the same experiment, I did not hear of it; I do not believe others ever exercised the patience to bring the experiment to the present state of perfection. At first I was troubled to find stalks with even two good ears on them; perhaps one good ear and one small one, or one good ear and a 'nubbin.' It was several years before I could discover much benefit resulting from my efforts; however, at length the quality and quantity began to improve, and the improvement was then very rapid. At present I do not pretend to lay up any seed without it comes from stalks which bear four, five, or six ears. I have seen stalks bearing eight ears. One of my neighbours informed me that he had a single stalk with ten perfect ears on it, and that he intended to send the same to the museum at Baltimore. In addition to the number of ears, and, of course, the great increase in quantity unshelled, it may be mentioned that it yields much more than the common corn when shelled. Some gentlemen, in whom I have full confidence, informed me that they shelled a barrel (10 bushels of ears) of my kind of corn which measured a little more than six bushels. The common kind of corn will measure about five bushels only. I believe I raise double, or nearly so, to what I could with any other corn I have ever seen. I generally plant the corn about the first of May, and place the hills five feet apart each way, and have two stalks in a hill.

"Early last spring I let George Law, Esq., of Baltimore City, have some of this seed corn; he sent it to his friend in Illinois, with instructions how to manage it. A few weeks since he informed me that the increase was 120 bushels to the acre; that there was no corn in Illinois like it, and that it produced more fodder than any other kind. I have supplied many friends with seed corn, but some of them have planted it with other corn, and will, I fear, find it degenerate.

"I have lately been inquired of if this corn was not later than any other kinds. It is rather earlier, certainly not later. Corn planted in moist or wet soils will not ripen so quick as that planted on a dry soil. In the former there will be found more dampness in the cob, although the kernel may appear ripe in both. In the two last years, the wet seasons have injured much corn that was early lofted or housed."

Culture of Indian Corn, by Judge Buel.—"*The soils adapted to the culture of Indian corn* are such as are permeable to heat, air, and the roots of the plant, and embrace those denominated sandy, gravelly, and loamy. Corn will not succeed well on grounds that are stiff, hard, or wet. The roots grow to as great length as the stalks, and the soil must be loose to permit their free extension.

"*The manures used* are generally yard and stable dung, and plaster of Paris (*sulphate of lime*). The first ought to be abundant, as upon the fertility which it induces depends the profit of the crop. Long or unfermented manure is to be preferred. It decomposes as the wants of the plant require it; while its mechanical operation, in rendering the soil light and porous, is beneficial to the crop. It should be equally spread over the whole surface before it is ploughed under. It then continues to afford fresh pasture to the roots till the corn has matured, and is, in its place, to benefit the succeeding crop. If put into the hills, the roots soon extend beyond its influence; it does not so readily decompose, and the subsequent crop is prejudiced from its partial distribution in the soil. In a rotation of four or five years, in which this crop receives the manure, twenty-five or thirty ordinary loads may be applied to *one* acre with greater profit than to *two* or *three* acres. Every addition tells in the product; and there is scarcely any danger of manuring too high for this favourite crop. Gypsum is applied broad-cast before the last ploughing or harrowing, or strewed on the hills after hoeing. I pursued the first method, at the rate of a bushel to the acre.

"*The best preparation for a corn crop* is a clover or other grass lay, or lea, well covered with long manure, recently spread, neatly ploughed, and harrowed lengthwise of the furrow. A roller may precede the harrow with advantage. The time of performing these operations depends upon the texture of the soil and the quality of the sod. If the first is inclining to clay, or the latter tough or of long continuance, the ploughing may be performed the preceding autumn; but where sand or gravel greatly preponderate, or the sod is light and tender, it is best performed in the spring, and as near to the planting as convenient. The harrow, at least, should immediately precede planting. All seeds do best when put into the fresh-stirred mould. Stiff lands are meliorated and broken down by fall ploughing, but light lands are rather prejudiced by it. When corn is preceded by a tilled crop, the ground should be furrowed, and the seed deposited in the bottoms of the furrows. Where there is a sod, the rows should be superficially marked, and the seed planted upon the surface. Where the field is flat, or the subsoil retentive of moisture, the land should be laid in ridges, that the excess of water which falls may pass off in the furrows.

"*The time of planting* must vary in different districts and in different seasons. The ground should be sufficiently warmed by vernal heat to cause a speedy germination. Natural vegetation affords the best guide. My rule has been to plant when the apple is bursting its blossom buds, which has generally been between the 12th and 20th of May.

"*Preparation of the Seed.*—The enemies to be combated are the wire-worm, brown grub, birds, and squirrels. Of these, the first and last two prey upon the kernels, and against these tar offers a complete protection. I soak my seed twelve hours in *hot* water, in which is dissolved a few ounces of crude saltpetre. When the corn has been thus soaked, I take for each half bushel of seed half a pint of tar, put it into an iron vessel with water, and heat it till the tar is dissolved, when it is turned upon the seed in steep. The mass is well stirred, the corn taken out, and as much plaster added as will adhere to the grain. This impregnates and partially coats the seed with the tar. The experience of years will warrant me in confidently recommending this as a protection for the seed.

"*The manner of planting* is ordinarily in hills, from two and a half to six feet apart, according to the variety of corn, the strength of the soil, and the fancy of the cultivator. The usual distance in my neighbourhood is three feet. Some, however, plant in drills of one, two, and three rows, by which a greater crop is unquestionably obtained, though the expense of culture is somewhat increased.

"*The quantity of seed* should be double, and may be quadruple of what is required to stand. It is well known that a great difference is manifest in the appearance of the plants. Some appear feeble and sickly, which the best nursing will not render productive. The expense of seed and the labour of pulling up all but three or four of the strongest plants in a hill, it is believed, will be amply remunerated by the increased product. If the seed is covered, as it should be, with fine mould only, and not too deep, we may at least calculate upon every hill or drill having its requisite number of plants.

"*The after culture* consists in keeping the soil loose and free from weeds, which is ordinarily accomplished by two dressings, and in thinning the plants, which latter may be done the first hoeing, or partially omitted till the last. The practice of ploughing among corn and of making large hills is justly getting into disrepute; for the plough bruises and cuts the roots of the plants, turns up the sod and manure to waste, and renders the crop more liable to suffer by drought. The first dressing should be performed as soon as the size of the plants will permit; and the best implement to precede the hoe is a corn-harrow, adapted to the width of the rows, which every farmer can make. This will destroy most of the weeds and pulverize the soil. The second hoeing should be performed before or as soon as the tassels appear, and may be preceded by the corn-harrow, a shallow furrow of the plough, or, what is better than either, by the cultivator. A slight earthing is beneficial, providing the earth is scraped from the surface, and the sod and manure not exposed. It will be found beneficial to run the harrow or cultivator a third, and even a fourth time, between the rows, to destroy weeds and loosen the surface, particularly if the season is dry.

"*In harvesting the crop*, one of three modes is adopted, viz.: 1. The corn is cut at the surface of the ground when the grain has become glazed or hard upon the outside, put immediately into stooks, and, when sufficiently dried, the corn and stalks are separated, and both secured. 2. The tops are taken off when the corn has become glazed, and the grain permitted to remain till October or November upon the butts. Or, 3. Both corn and stalks are left standing till the grain has fully ripened, and the latter become dry, when both are secured. There are other modes, such as leaving the butts or entire stalks in the field after the grain is gathered; but these are so wasteful and slovenly as not to merit consideration. The stalks, blades, and tops of corn, if well secured, are an excellent fodder for neat cattle. If cut, or cut and steamed, so that they can be readily masticated, they are superior to hay. Besides, their fertilizing properties as a manure are greatly augmented by being fed out in the cattle-yard, and imbibing the urine and liquids which always there abound, and which are lost to the farm, in ordinary yards, without an abundance of dry litter to take them up. By the first of these methods the crop may be secured before the autumnal rains; the value of the fodder is increased, and the ground is cleared in time for a winter crop of wheat or rye. The second mode impairs the value of the forage, requires more labour, and does not increase the quantity or improve the quality of the grain. The third mode requires the same labour as the first, *may* improve the quality of the grain, but must inevitably deteriorate the quality of the fodder. The corn cannot be husked too promptly after it is gathered from the field. If permitted to heat, the value of the grain is seriously impaired.

"*Sowing Seed.*—The fairest and soundest ears are either selected in the field, or, at the time of husking, a few of the husks being left on, braided, and preserved in an airy situation till wanted for use.

"*In making choice of sorts*, the object should be to obtain the varieties which ripen early and afford the greatest crop. I think these two properties are best combined in a twelve-rowed kind which I obtained from Vermont some years ago, and which I call Dutton corn, from the name of the gentleman from whom I received it. It is earlier than the common eight-rowed yellow, or any other field variety I have seen, and, at the same time, gives the greatest product. I have invariably cut the crop in the first fourteen days of September, and once in the last week in August. The cob is large, but the grain is so compact upon it that two bushels of sound ears have yielded five pecks of shelled grain, weighing 62 lbs. the bushel.

"*In securing the fodder*, precaution must be used. The butts become wet by standing on the ground, and if placed in large stacks or in the barn, the moisture which they contain often induces fermentation and mouldiness. To avoid this, I put them first in stacks so small that the whole of the butts are exposed upon the outer surface; and, when thoroughly dry, they may be taken to the barn, or left to be removed as they are wanted to be fed out, merely regarding the propriety of removing a whole stack at the same time.

"(a) *Estimated Expense of Cultivating an Acre of Indian Corn.*

One ploughing (suppose a clover lay) .	$2 00
Harrowing and planting	2 00
Two hoeings, 4 days and horse team .	3 75
Harvesting, two days	1 50
Cutting and harvesting stalks . . .	1 50
Rent	5 00
	$15 75

"(b) The following table exhibits the difference in product of various methods of planting, and serves also to explain the manner in which large crops of this grain have been obtained I have assumed in the estimate that each stock produces one ear of corn, and that the ears average one gill of shelled grain. This is estimating the product low; for while I am penning this (October), I find that my largest ears give two gills, and 100 fair ears half a bushel of shelled corn. The calculation is also predicated upon the supposition that there is no deficiency in the number of stocks, a contingency pretty sure on my method of planting.

	Hills.	bush.	qts.
1. An acre in hills, 4 feet apart each way, will produce .	2,722	42	16
2. The same, 3 by 3 feet .	4,840	75	20
3. The same, 3 by 2½ feet .	5,808	93	28
4. The same, in drills at 3 feet, plants 6 stalks, one inch apart in the drills . .	29,040	113	14
5. The same in do., 2 rows in a drill, 6 inches apart, and the plants 9 inches, and 3 feet 9 inches from centre of drills, thus . . .	30,970	120	31
6. The same in do., 3 rows in a drill, as above, 3 feet from centre of drills .	43,560	170	5

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"The fifth mode I have tried. The ground was highly manured, the crop twice cleaned, and the entire acre gathered and weighed accurately the same day. The product in ears was 103 baskets, each 84 lbs. nett, and 65 lbs. over. The last basket was shelled and measured, which showed a product on the acre of 118 bushels 10 quarts. I gathered at the rate of more than 100 bushels the acre from four rods planted in the third method last summer, the result ascertained in the most accurate manner. Corn shrinks about 20 per cent. after it is cribbed. The sixth mode is the one by which the Messrs. Pratt, of Madison county, obtained the prodigious crop of 170 bushels per acre. These gentlemen, I am told, are of opinion that the product of an acre may be increased to 200 bushels.

"*Cutting the Stalks.*—For a few years past I have not cut my corn-stalks until the corn was harvested, *guessing* that it was a course preferable to the one commonly pursued in this part of the country, of topping the stalks while in a green state. But for the purpose of settling this point more clearly, and with as little trouble as the case would admit, I selected, about the 5th of September, a row of corn in a field of about five acres, intending to take one that would average in quality equal to the field throughout, that I might, at the same time, be able to ascertain, with tolerable certainty, the product of the whole field. The manure having been spread on the surface of the ground, and harrowed in lengthwise of the furrows, and the corn planted across the furrows, made it apparently less difficult to select an average row. On this row I cut the stalks from half the hills; beginning at one end, and cutting the first hill, then leaving the next uncut, and so proceeding alternately, cutting one, and leaving the next uncut, through the row. I had intended to confine the experiment to this row, but finally was led to extend it so far as to include four rows; and, numbering them agreeably to the order in which they were standing in the field, this row may be called No. 2. There were ninety-two hills in the row, and the stalks were cut from forty-six hills, all of them in the manner that is here termed jointing, *i. e.*, cut off between the ear and the first joint above the ear. I thought they were somewhat more ripe than is usual at the time of cutting; a few of them were nearly dry. The soil was a sandy or gravelly loam, anciently covered with pine, oak, and chestnut. In hoeing the corn, no hills were made, but some care was taken that the surface of the ground should remain as level as possible through the season.

"My estimate of the number of hills on an acre was made in the following manner; and, if I am wrong in my calculations, I shall be corrected by some of your readers.

"In an area of 200 feet square (or 40,000 square feet), there were sixty-two rows, with fifty-four hills in a row, making 3348 hills. This is equal to 3646 hills per acre, each hill occupying nearly twelve square feet of surface. There were about four stalks of corn in a hill. In estimating bushels, I have allowed the lawful weight of fifty-six pounds to the bushel.

"At the time of harvesting, the corn was husked in the field. The forty-six hills from which the stalks had been cut gave forty-eight and a half pounds of ears; and the forty-six hills on which the stalks had not been cut gave sixty-two pounds of ears. The number of ears in the two cases was about the same; those from the uncut hills were evidently the best filled out and the most hale; on a large proportion of them the kernels were so closely wedged in as to make it difficult to bend the ear at all without breaking it. There was very little mouldy corn in either case; a few ears were gathered, mostly from the cut stalks, but the whole quantity was so small as to make it questionable whether cutting the stalks had much effect in this particular.

"Both parcels were carefully laid aside in a dry chamber for about six or eight weeks, at the expiration of which time they were again weighed, and the parcel of ears from the uncut hills had lost in drying about two per cent. more than the other, affording some evidence that the sap continued to circulate for a greater length of time in the uncut than in the cut stalks. The uncut hills gave 42 pounds 8 ounces dry shelled corn, equal to 14 ounces 12½ grains per hill, or 60 bushels and eight pounds per acre. The parcel from the cut hills gave 33 pounds 7 ounces, equal to 11 ounces 10 grains per hill, or 47 bushels and 18 pounds per acre, making a loss of 12 bushels and 46 pounds per acre by cutting the stalks; conclusive evidence that, while the sap is in circulation, nature does not assign the stalks an unprofitable office. The product of this whole row, taken together, cut and uncut hills, was equal to 53 bushels and 41 pounds per acre.

"The product of row No. 3, taken by itself (containing ninety-two hills, on one half of which the stalks were cut on the same day the others were), would not show the practice of cutting stalks quite so destructive in its effects as that exhibited in row No. 2. Its whole produce was 77 lbs. 9 oz. dry corn, equal to 55 bushels and 10 pounds per acre, or 1 bushel and 25 pounds per acre more than row No. 2.

"Not satisfied with resting the experiment here, I gathered the corn on rows Nos. 1 and 4, *i. e.*, the rows each side next adjoining Nos. 2 and 3, and on which none of the stalks had been cut. These rows, taken together, contained 186 hills, and their product of dry shelled corn was 171 lbs. 13 oz., equal to 14 oz. 12½ grs. per hill, or 60 bushels and 8 pounds per acre, precisely the same average yield as that part of row No. 2 on which the stalks had not been cut. This *exact* coincidence, however, I think, may be numbered among those cases which rarely happen.

"The difference between the two rows on which half the stalks were cut and the two rows on which none of the stalks were cut was 5 bushels 38½ pounds per acre. If this difference arose from cutting half the stalks (and I know of no other reason), then cutting the whole would have reduced the crop 11 bushels and 21 pounds per acre, or from 60 bushels and 8 pounds to 48 bushels and 43 pounds per acre.

"To recapitulate, row No. 2, on which the experiment was commenced, taken by itself, is as follows, viz.:

46 hills, on which the stalks had *not* been cut, gave 42 lbs. 8 oz. dry shelled corn, equal to, per acre . . .	60	bush.	8 lbs.
46 hills, from which the stalks *had* been cut, gave 33 lbs. 7 oz. dry shelled corn, equal to, per acre . . .	47	"	18 "
Loss by cutting the stalks, per acre	12	"	46 "

The four rows, taken together, stand as follows:

Nos. 1 and 4, on which no stalks were cut, gave an average of, per acre . .	60	bush.	8 lbs.
Nos. 2 and 3, from which half the stalks were cut, gave an average of, per acre .	54	"	25½ "
Loss by cutting one half the stalks, per acre, . .	5	"	38½ "
			2
On cutting all the stalks, would make a loss equal to, per acre	11	"	21 "

"The difference in the result of the two cases is 1 bushel and 25 pounds per acre; or in the two experiments (if it may be so termed) there is an average loss, by cutting the stalks, of 12 bushels 5½ pounds per acre; a loss quite equal to all the expense of hoeing and harvesting, especially when we consider that in hoeing the labour of making hills was dispensed with.

"If I had cut all the stalks, and obtained a crop of forty-eight bushels to the acre, the very fact of having forty-eight bushels would, I think, be considered by farmers generally, in this section of the country, as proof positive that the stalks were cut without injury to the crop. Or, if I had gone one step farther, and made large hills at an additional expense of one dollar per acre, and thereby reduced the crop to forty-five bushels per acre, the forty-five bushels would be considered sufficient proof that making hills (which, by-the-way, are usually made equally large and high on wet or dry land, without regard to soil or situation) was labour well laid out; for although you occasionally give us a *large corn story*, swollen a little, perhaps, by *guessing* it off in *baskets*, yet, judging from what we see and know about raising corn, we call forty-five bushels per acre a good crop.

"A measured bushel from the cut hills weighed 57 lbs. 6 oz., one pound less than from the *uncut*, the shrinkage being very near equal to the whole loss in weight.

"If this experiment is a fair test, it seems *that about twenty per cent., or one fifth part of the crop, is destroyed by cutting the stalks in the way they are usually cut.* If farther experiment should establish this fact, I think there are few farmers that will hesitate long in deciding which is the most valuable, one acre of corn or five acres of top stalks. But this twenty per cent. is not saved at the expense of losing the stalks; they are worth as much, and, I think, more, all things considered, after the corn is harvested, than they are gathered in the usual way. If, after being bunched up in a green state, they heat or become mouldy (a case of frequent occurrence), they are utterly worthless, except it be for manure; I know of no animal that will eat them. But after they have once been dried by the frost and wind, a subsequent moderate degree of mouldiness seems to be no injury.

"The course which I have pursued with them, and for the present I know of no better, has been as follows: In the first place, they are cut off near the ground, and for this purpose a short scythe is found the most convenient instrument. The expense of cutting in this manner, however, is but a mere trifle, if any, more than cutting the stub stalks in the spring, and may, with propriety, be entered as an item of expense against the next crop, for which it is preparing the ground. After cutting, they are gathered into bunches of suitable size for binding, and three good sheaves of rye straw, if wet, will be sufficient to bind a ton. In gathering them up and laying in bunches, an active boy will do as much as a man. In this way, the whole expense of gathering, binding, and loading will not exceed 75 cents per ton. As they are very bulky, for want of barn room, I have them stacked near the barn-yard; and I think I may safely say that my cattle eat more pounds of stalks from an acre gathered in this way than they would from the same acre if gathered in the usual way. It may be objected to this, that they are not as good and nourishing as others: as to that matter, I am not able to say; but, if the cattle are good judges in the case (and I think they ought to be admitted as such), they are quite as good and quite as nourishing, for they are eaten apparently with quite as good a relish. In addition to this, they are obtained without breaking off ears or breaking down hills in hauling out, occurrences quite frequent in the other case. They also furnish more than double the quantity of bedding for the yard, an item of no small moment in the list of 'creature comforts' during our cold winters. And last, though not least, they make more than double the quantity of manure, the value of which will be duly appreciated by every good farmer without argument. It may be said that the butt stalks can be gathered after harvest, and furnish the same quantity of litter and manure as in this case. That is true; but the expense of gathering both parts in that way, from the butts being so short and inconvenient to bind, would be three times as much as it is to gather them whole. Thus, viewing the subject in various points, I think this method of managing corn-stalks is much better than the old one; and that a little observation and experience will convince the most skeptical that this branch of agriculture is not yet brought to a state of perfection; that there is yet room for improvement." — (*Farmer's Instructer.*)

Much discussion has arisen on the Northern and Southern plan of cultivating corn: the first in hills of three to five stems, the other in rows five feet wide; and also on the propriety of hilling or planting level. The Northern method is best, as the yield shows, so far as closer planting is concerned; but the height of the plants is very different, so that the close planting of the North can hardly be imitated. As to the planting in drills, with water-furrows between them, the propriety of this method depends on the nature of the soil, for stiff clays must be so managed, otherwise the heavy rains would destroy the crop; but in light soils a level surface is most advantageous.

For the value of maize as food, see the articles *Fodder* and *Food*.

CORN FOR SUGAR. The stems of corn, as they begin to turn in colour, contain, according to some writers, twelve to fourteen per cent. of sugar in the juice, if the ears have been removed as fast as they appear. The juice is expressed precisely as from the cane, and treated in the same way; perhaps it requires more rapidity of movement. Six per cent. of sugar is sometimes obtained from the juice, and from 300 to 500 pounds the acre. The question of economy is the only one which embarrasses the public: this has been settled adversely, so far as regards the country in which the sugar cane grows, by Messrs. Tillotson, of Louisiana, but is open for the Western and Middle States, and in places where corn sells at a low price and sugar is at eight cents the pound; we therefore introduce Messrs. Webb and Mapes's account, from the Hon. H. C. Ellsworth's report:

"*Remarks on the Manufacture of Corn Sugar, by William Webb, of Wilmington, Delaware.*

"In common with many others, I have felt considerable interest in the plan for extending the cultivation of sugar in temperate climates, and have made many experiments, first upon the beet, and recently upon maize or Indian corn, in the hope of discovering some mode by which the desired end might be attained.

"The results from the latter plant have been extremely encouraging. The manufacture of sugar from it, compared with that from the beet, offers many advantages. It is more simple, and less liable to failure; the machinery is less expensive, and the amount of fuel required is less by one half. The quantity of sugar produced on a given space of ground is greater, besides being of better quality. An examination into the nature and productive powers of these two plants will show that no other results could have been reasonably expected. It is a well-established fact, that every variety of production found in plants is derived from the sap. It is also ascertained that the principal substance found in the sap or juice of many vegetables is sugar; therefore, the amount of saccharine matter produced by any plant of this description may be estimated from an analysis of the fruit, seed, &c., of such plant, when ripe. The grain yielded by corn, and the seed from beet, in the second summer of its growth, are nothing more than this sap or juice elaborated by the process of vegetation, and presented to our view in another form.

"Now, as it is contrary to the economy of nature to suppose that there should be any loss of nutritive matter in this change of sap into seed or grain, does it not follow that there must be the same difference in the quantity of sugar produced by the two plants as there is between the nutritive properties of beet seed and corn?

"The juice of maize contains sugar, acid, and a gummy, mucilaginous matter, which forms the scum. From the experiments of Gay Lussac, Thenard, Kirchoff, and others, it is proved that starch, sugar, and gum are extremely similar in composition, and may be as readily converted into each other by chemical processes as they are by the operation of nature. For example: starch, boiled in diluted sulphuric acid for thirty-six hours, is converted into sugar of greater weight than the starch made use of.

"This result goes to show that every pound of starch found in the seed of a plant has required for its production at least one pound of sugar in the form of sap. If it be objected that this deduction is too theoretical to be admitted, it may be answered, that experiment, so far as it has gone, has fully attested its correctness.

"The raw juice of maize, when cultivated for sugar, marks 10° on the saccharometer, while the average of cane juice (as I am informed) is not higher than 8°, and beet juice not over 3°.

"From 9¾ quarts (dry measure) of the former I have obtained 4 pounds 6 ounces of sirup, concentrated to the point suitable for crystallization. The proportion of crystallizable sugar appears to be larger than is obtained from cane juice in Louisiana. This is accounted for by the fact that our climate ripens corn perfectly, while it but rarely, if ever, happens that cane is fully matured. In some cases the sirup has crystallized so completely, that less than one sixth part of molasses remained. This, however, only happened after it had stood from one to two months. There is reason to believe that, if the plant were fully ripe, and the process of manufacture perfectly performed, the sirup might be entirely crystallized without forming any molasses.

"This perfection in the manufacture cannot, however, be attained with the ordinary apparatus. Without any other means for pressing out the juice than a small hand mill, it is impossible to say how great a quantity of sugar may be produced on an acre.

"The experiments have been directed more to ascertain the saccharine quality of corn-stalk than the amount a given quantity of ground will produce; but the calculations made, from trials on a small scale, leave no room to doubt that the quantity of sugar will be from 800 to 1000 pounds. This amount will not appear unreasonable when it is considered that the juice of corn is as rich as that of cane, and the weight of green produce at least equal.

"Mr. Ellsworth, in one of his publications, states, as the result of actual weighing and measuring, that corn, sown broad-cast, yielded five pounds of green stalks per square foot; this is at the rate of 108½ tons to the acre.

"My attention was first directed to maize as a material for sugar by observing that, in some stalks, the juice was extremely sweet, while in others it was weak and watery. On examination, it appeared that the latter had borne large and perfect ears of grain, while on the former these were either small in size or entirely wanting. The natural conclusion from this observation was that, if the ears were taken off in their embryo state, the whole quantity of saccharine matter produced by the process of vegetation would be preserved in the stalk, from which it might be extracted when the plant was matured; but the idea occurred too late in the season to test it by experiment. A few stalks, however, were found, which, from some cause, had borne no grain; these were bruised with a mallet, and the juice extracted by a lever press. Some lime was then added, and the desiccation, evaporation, &c., began and finished in a single vessel. By these simple means sugar of a fair quality was produced, which was sent to the horticultural exhibition of our society in 1840.

"I have since been informed, by Mr. Ellsworth, that Mons. Pallas, of France, had discovered, in 1839, that the saccharine properties of maize were increased by merely taking off the ear in its embryo state. An experiment, however, which I instituted to determine the value of this plan resulted in disappointment: the quantity of sugar produced was not large enough to render it an object. The reasons of this failure will be sufficiently obvious on stating the circumstances. It was found that taking the ear off a large stalk, such as is produced by the common mode of cultivation, inflicted a considerable wound upon the plant, which injured its health, and, of course, lessened its productive power. It was also found that the natural disposition to form grain was so strong that several successive ears were thrown out, by which labour was increased and the injuries of the plant multiplied. Lastly, it appeared that the juice yielded from those plants contained a considerable portion of foreign substance not favourable to the object in view. Yet, under all these disadvantages, from one hundred to two hundred pounds of sugar per acre may be obtained.

"The manifest objections detailed above suggested another mode of cultivation, to be employed in combination with the one first proposed; it consists simply in raising a greater number of plants on the same space of ground. By this plan all the unfavourable results above mentioned were obviated, a much larger quantity of sugar was produced, and of better quality. The juice produced by this mode of cultivation is remarkably pure and agreeable to the taste. Samples of the sugar yielded by it are now in the Patent Office, with a small hand mill by which the stalks were crushed. Some of the same kind was exhibited to our agricultural society in October, 1841, accompanied with an answer to an invitation from its president, Dr. J. W. Thompson, to explain the mode of culture and process of manufacturing the sugar. The molasses, after standing, as before mentioned, from one to two months, became filled with small crystals, which, on being drained, exhibited a peculiar kind of sugar; the grain is small, and somewhat inferior in appearance, but still is as sweet and agreeable to the taste as can be desired. A small sample of this sugar I have brought for your inspection. This product, from what was thought to be molasses, is a new and unexpected discovery, and discloses an important fact in the investigation of this subject. It shows the superior degree of perfection attained by the corn plant, compared with the cane, in any part of the Union. It is generally understood that the latter cannot be fully matured in any except a tropical climate, and the proportion of molasses obtained from any plant is greater or less according to the immaturity or perfection of its growth. The sweetness of the corn-stalk is a matter of universal observation. Our forefathers, in the revolutionary struggle, resorted to it as a means to furnish a substitute for West India sugar. They expressed the juice, and exerted their ingenuity in efforts to bring it to a crystallized state; but we have no account of any successful operation of the kind. In fact, the bitter and nauseous properties contained in the joints of large stalks render the whole amount of juice from them fit only to produce an inferior kind of molasses. I found, on experiment, that, by cutting out the joints, and crushing the remaining part of the stalk, sugar might be made, but still of an inferior quality. The molasses, of which there was a large proportion, was bitter and disagreeable.

"From one to two feet of the lower part of these stalks was full of juice; but the balance, as it approached the top, became dryer, and afforded but little. From the foregoing experiments, we see that, in order to obtain the purest juice, and in the greatest quantity, we must adopt a mode of cultivation which will prevent the large and luxuriant growth of the stalk.

"As we are upon the threshold of this inquiry, many other improvements may be expected in the mode of operation; for example, it may be that cutting off the tassel as soon as it appears on the plant will prevent the formation of grain, and prove a preferable means for effecting that object.

"On the whole, there appears ample encouragement for perseverance. Every step in the investigation has increased the probabilities of success, no evidence having been discovered why it should not succeed as well, if not better, on a large scale, than it has done on a small one.

"1. In the first place, it has been satisfactorily proved that sugar of an excellent quality, suitable for common use without refining, may be made from the stalks of maize.

"2. That the juice of this plant, when cultivated in a certain manner, contains saccharine matter remarkably free from foreign substances.

"3. The quantity of this juice (even supposing we had no other evidence about it) is sufficiently demonstrated by the great amount of nutritive grain which it produces in the natural course of vegetation. It is needless to expatiate on the vast advantages which would result from the introduction of this manufacture into our country.

"Grain is produced in the West in such overflowing abundance that the markets become glutted, and inducements are offered to employ the surplus produce in distillation. This business is now becoming disreputable. The happy conviction is spreading rapidly, that the use of alcohol, as a beverage, instead of conducing to health and strength, is the surest means of destroying both. Some other production, therefore, will be required, in which the powers of our soil may be profitably employed. This, it is hoped, will be found in the business now proposed. Instead of distilleries, converting food into poison, we may have sugar-houses, manufacturing at our doors an article of universal demand, not merely useful, but necessary, furnishing as it does one of the most simple, natural, and nutritious varieties of human sustenance found in the whole range of vegetable production.

"It is said that the general use of sugar in Europe has had the effect to extinguish the scurvy and many other diseases formerly epidemical. It may be doubted whether a tropical country can ever furnish a great amount of exports, except through the means of compulsory labour. It appears, then, highly probable, that if the inhabitants of temperate countries wish to continue the use of sugar, they must find some means to produce it themselves. The beet appears to succeed well in Europe, and the manufacture from it is extending rapidly; but there is no hazard in making the assertion that Indian corn is far better adapted to our purpose. The following mode of cultivating the plant and making the sugar is the best that can now be offered. The kind of soil best adapted to corn is so well understood, that no directions on this point are necessary, except that it should be rich—the richer the better; if not naturally fertile, manure must be applied, either ploughed in or spread upon the surface, or used both ways, according to the ability of the owner. Nothing can form a better preparation for the crop than a clover sod well turned under and harrowed fine immediately before planting.

"Select for seed the largest and best ears of any variety of corn not disposed to throw up suckers or spread out in branches; that kind most productive in the neighbourhood will be generally the one best adapted to the purpose. The planting should be done with a drilling machine. One man, with a pair of horses and an instrument of this kind, will plant and cover, in the most perfect manner, from ten to twelve acres in a day; the rows (if practicable, let them run north and south) two and a half feet apart, and the seed dropped sufficiently thick in the row to ensure a plant every two or three inches. A large harrow, made with teeth arranged so as not to injure the corn, may be used to advantage soon after it is up. The after culture is performed with a cultivator, and here will be perceived one of the great advantages of drilling: the plants all growing in lines, perfectly regular and straight with each other, the horse-hoe stirs the earth and cuts up the weeds close by every one, so that no hand hoeing will be required in any part of the cultivation. 'It is part of the system of cane-planting in Louisiana, to raise as full a stand of cane upon the ground as possible, experience having proved that the most sugar is obtained from the land in this way.' As far as my experience has gone, the same thing is true of corn. This point must therefore be attended to, and the deficiencies, if any occur, made up by timely replanting.

"The next operation is taking off the ears. Many stalks will not produce any; but, whenever they appear, they must be removed. It is not best to undertake this work too early, as, when the ears first appear, they are tender, and cannot be taken off without breaking, which increases the trouble. Any time before the formation of grain upon them will be soon enough.

"Nothing farther is necessary to be done until the crop is ready to cut for grinding. In our latitude, the cutting may commence with the earlier varieties about the middle of August. The later kinds will be ripe in September, and continue in season until cut off by the frost. The stalks should be topped and bladed while standing in the field. They are then cut, tied in bundles, and taken to the mill. The top and blades, when properly cured, make an excellent fodder, rather better, it is believed, than any hitherto used; and the residuum, after passing the rollers, may easily be dried and used in the same way: another advantage over the cane, which, after the juice is expressed, is usually burned.

"The mills should be made on the same general principle employed in constructing those intended for grinding cane. An important difference, however, will be found both in the original cost and in the expense of working them. Judging from the comparative hardness of the cane and corn-stalk, it is believed that one fourth part of the strength necessary in the construction of a cane mill will be amply sufficient for corn, and less than one fourth part of the power will move it with the same velocity. It may be made with three upright wooden rollers, from twenty to forty inches in length, turned so as to run true, and fitted into a strong frame-work, consisting of two horizontal pieces, sustained by uprights. These pieces are mortised to admit wedges on each side the pivots of the two outside rollers, by which their distances from the middle one may be regulated. The power is applied to the middle roller, and the others are moved from it by means of cogs. In grinding, the stalks pass through on the right side of the middle cylinder, and come in contact with a piece of frame-work called the dumb returner, which directs them backward, so that they pass through the rollers again, on the opposite side of the middle one. The modern improved machine is made entirely of iron, three horizontal rollers, arranged in a triangular form, one above and two below; the cane or stalk passes directly through, receiving two pressures before it escapes. The lower cylinders are contained in a small cistern which receives the juice. The latter machine is the most complete; the former the least expensive. These mills may be moved by cattle; but, for large operations, steam or water power is preferable. When the vertical cylinders are turned by cattle, the axis of the middle one has long levers fixed across it, extending from ten to fifteen feet from the centre. To render the arms firm, the axis of this roller is carried up to a considerable height, and oblique braces of wood, by which the oxen or horses draw, are extended from the top of the vertical axis to the extremities of each of the arms. When horizontal cylinders are propelled by animal power, the upper roller is turned by the cogs at one end, which are caught by cogs on a vertical shaft. It is said that, in the West Indies, the purest cane juice will ferment in twenty minutes after it enters the receiver. Corn juice has been kept for one hour before boiling without any apparent injury resulting; but so much delay is not desirable, as it may be attended with bad effects.

"The process which has been employed in the manufacture of maize sugar is as follows: The juice, after coming from the mill, stood for a short time to deposite some of its coarser impurities. It was then poured off, and passed through a flannel strainer, in order to get rid of such matters as could be separated in this way. Lime-water, called milk of lime, was then added, in the proportion of one or two table-spoonfulls to the gallon. It is said by sugar manufacturers that knowledge on this point can only be acquired by experience; but I have never failed in making sugar from employing too much or too little of the lime. A certain portion of this substance, however, is undoubtedly necessary, and more or less than this will be injurious, but no precise directions can be given about it. The juice was then placed over the fire, and brought nearly to the boiling point, when it was carefully skimmed, taking care to complete this operation before ebullition commenced. It was then boiled down rapidly, removing the scum as it rose. The juice was examined from time to time, and if there was any appearance of feculent particles, which would not rise to the surface, it was again passed through a flannel strainer. In judging when the sirup is sufficiently boiled, a portion was taken between the thumb and finger, and if, when moderately cool, a thread half an inch long could be drawn, it was considered to be done, and poured into broad, shallow vessels to crystallize. In some cases, crystallization commenced in twelve hours; in others, not till after several days; and in no case was this process so far completed as to allow the sugar to be drained in less than three weeks from the time of boiling. The reason why so great a length of time was required I have not yet been able to discover. There is no doubt that an improved process of manufacture will cause it to granulate as quickly as any other.

"Enough has been said to enable any one so disposed to manufacture sugar from maize.

"As to the profits of the business, I shall make no positive assertions; experience on the subject is yet too limited to warrant them; and, as all the facts in relation to it are now before the public, every one interested can draw his own conclusions. It is said, by those acquainted with the cultivation of the cane, that that business cannot be carried on profitably on less than one hundred acres in crop, and that attempts on a small scale will be certain to fail, with a great loss of time and labour. How far this may be applicable to corn remains to be seen.

"Some comparison between the cultivation of cane and that of corn may perhaps be interesting.

"The cane lands in Louisiana are redeemed to agriculture by strong embankments along the river, and by numerous ditches, which extend back into the swamp to a considerable distance beyond the line of cultivation. The ground is still farther divided, by smaller ditches, into lots of from one to two acres in extent. It is extremely rich and productive, but the expense of draining and keeping up the embankments must be considerable; this forms the first difference to be noted in the culture of the two plants under consideration.

"The best season for planting cane in Louisiana is in the fall, which is also the time of harvest, when labour is the most valuable, and the greatest exertions are required to secure the crop before it is destroyed by frost.

"But the most striking difference will be found in the cost of seed, and in the labour of planting. The cane is propagated by layers; these are partly furnished from the tops of the plants when cut for grinding, but are principally ratoons. Of the latter, it requires the produce of one acre to plant three. The grain from one acre of corn will be sufficient for planting forty acres; therefore, the difference in the expense for seed will be as one to thirteen.

"In planting cane, furrows are made with the plough from two and a half to three feet apart; in these the layers are placed in a double row, and the earth drawn over them with hoes to the depth of three or four inches.

"In the spring, before the plants are up, this covering is partly scraped off, so as to leave them buried from one to two inches. From this account, it is evident that no more manual labour will be required to drill fifty acres in corn than to plant one acre in cane. The labour of cultivating the latter plant during its growth is also greater, but this may be balanced by the extra work required to take off the embryo ears from the corn. When cultivated in the mode recommended, the stalk of corn is soft, remarkably heavy, and full of juice from bottom to top. The amount of power required for grinding them must be much less than is necessary for cane, or, what is the same thing, an equal power will do it with greater rapidity. The average yield of cane, in Louisiana, is one thousand pounds of sugar and forty-five gallons of molasses per acre. From the above comparative statement, it would appear that one half this amount of crop from corn would be equally, if not more profitable.

"I will only add, in conclusion, that whether or not the sugar from the corn-stalk may soon become an article of profitable export, its manufacture in the simplest form will enable every family to supply themselves with this article for common use, now become so much a necessary of life, and thus save a considerable bill of expense yearly paid for foreign sugars."

Mr. Mapes's Account.—"You request to know the best method of crystallizing corn sirup, and I know of no more ready method to afford the information required than to detail the entire mode which should be pursued for its manufacture:

"1st. To cut the cane as ripe as possible, but before any acetic acid is formed; litmus paper, touched to the fresh-cut cane, will turn red if acid.

"2d. Express the juice without loss of time, as every moment after cutting will deteriorate its quality.

"3d. A small quantity of clear lime-water (say one quart to a hundred gallons of juice) should be added the moment it is expressed, unless the juice shows acidity with litmus paper; in that case, no lime should be used, but a solution of sal soda, or soda ash, should be added, until it is precisely neutral.

"4th. When the juice is neutral (free from excess of acid or alkali) it should be evaporated in such an apparatus as would finish its charge in 30 minutes; if the boiling power is too small, good crystallization cannot possibly be obtained.

"The whole time occupied from the cutting of the cane to finishing its boiling should not exceed one hour.

"5th. *To know when the boiling is finished,* place a thermometer in the kettle, and continue to evaporate until it stands at 230° Fahrenheit. If, when placed to run off after cooling, it should be found too freely boiled, the next time boil to 240°, or, if too light to run off, to 238°, and so on.

"6th. The kettle or boiler should be so arranged that the moment it is done its charge should be thrown into a cooler capable of holding a number of charges. The first charge should be left in the cooler, with stirring, until the second charge is thrown in; then with an oar scrape the crystals found on the side and bottom of the cooler loose, and gently stir the whole mass together (the less stirred the better); so continue, at the letting in of each charge, to stir gently; and when all is in the cooler, let the whole stand until it cools down to 175°; then fill out into sugar moulds of a capacity not less than 14 gallons. When cooled in the mould sufficient (say fourteen hours), pull the plug out of the bottom of the mould, and insert a sharp point nearly as large as the hole, some six inches; withdraw the point, and stand the mould on a pot to drip.

"7th. If the sugar is intended to be brown, leaving it standing on the spot for a sufficient length of time, in a temperature of 80°, will run off its molasses, and leave it in a merchantable shape; it will probably require twenty days; it can then be thrown out of the moulds, and will be fit for use. When moulds cannot be obtained, conical vessels of wood or metal, with a hole at the apex, will answer equally well.

"The above description will be sufficient for any operator if strictly followed; but should any of your friends wish to make the experiment on a large scale, or to produce white instead of brown sugar at a single operation, they had better see me personally before commencing, as the kind of kettle, and many other minor particulars, will be important. The above description, however, is fully sufficient for the use of the farmer. If the juice of corn-stalks be manufactured with the rapidity named in the former part of this letter, no clarification will be necessary, and scum, which may rise during the boiling, can be taken off with a skimmer; but in the *large way* both clarification and filtration would be requisite, as in large operations every part of the kettle cannot be got at to skim. Since I last saw you I have made some experiments on the corn-stalk; and if your statements are correct as to the quantity of juice which can be obtained from the acre, then there can be no doubt of its entire superiority over the sugar-cane. I fear, however, that the enthusiasm of those who made the experiments you spoke of has led them into errors. It is true that the juice of the corn-stalk, grown with a view to sugar making, will yield a juice at 10° Beaumè. I have arrangements to try the experiments fully in the coming summer, and when done will communicate the result."

CORN FOR SOILING, or HAY. Corn sown broad-cast or in close drills has been much used of late for soiling; it is cut from four to six weeks old, and is relished by cattle when mixed with other fodders. It should be gradually introduced into their food, lest it produce scouring. An acre thickly set produces upward of six tons of dry fodder, and much more, according to some farmers. It is readily cured for hay by sweating in cocks, but cannot be dried enough by spreading in swarth only. As hay, it is nearly equal to fine grass, and readily eaten.

Corn is remarkably free from destructive diseases; the smut masses which affect the stems are seldom sufficiently abundant to destroy the crop; the caterpillars that prey on the leaves occasionally destroy a few young plants; the cutworm, in rich soils, is the severest enemy.

The young stems are occasionally infested with a caterpillar of a yellowish colour, with a black head and smooth, the larva of the *Gortyna zeæ*, or spindle-worm: they destroy the plants which they infest, but the numbers are usually limited.

CORN, SPECIAL MANURES. Poudrette, guano, and stable manure, composted with lime and bone dust, are the great fertilizers for this grain. It pre-eminently requires putrescent matter and bone earth, without which last the seeds are imperfect. The ash of Indian corn shows how much phosphoric acid it contains. (*Analyzed by Letellier.*)

Potash and soda	30·8
Lime and magnesia	18·3
Phosphoric acid	50·1
Silica, &c.	8
	100·0

A special mixture or compost of poudrette or stable manure, bone earth, and ashes would be very valuable.

CORN, MEASURING THE BULK. The following rule for this purpose is given by William Murray. It is not to be regarded as strictly accurate, but an approximation:

"Having previously levelled the corn in the house, so that it will be of equal depth throughout, ascertain the length, breadth, and depth of the bulk; multiply these dimensions together, and their products by 4; then *cut off one figure* from the right of this last product. This will give so many bushels, and a decimal of a bushel of shelled corn. If it be required to find the quantity of ear corn, substitute 8 for 4, and cut off one figure as before."

CORN LAWS. The exportation of grains to England having much increased, the following tables of the tariff will be useful to many farmers:

"According to the English Corn Law Act existing in 1842, corn inspectors are appointed in 287 towns, to transmit returns to the Board of Trade, who compute the average weekly price of each description of grain, and the aggregate average price for the previous six weeks, and transmit a certified copy to the collectors of customs at the different outports. The aggregate average regulates the duty on importation according to the following scale:

"*If imported from any Foreign Country.*

"*Wheat.*—Whenever the average price of wheat, made up and published in the manner required by law, shall be for every quarter

	£.	s.	d.
Under 51*s.*, the duty shall be for every quarter	1	0	0
51*s.* and under 52*s.*	0	19	0
52*s.* — 55*s.*	0	18	0
55*s.* — 56*s.*	0	17	0
56*s.* — 57*s.*	0	16	0
57*s.* — 58*s.*	0	15	0
58*s.* — 59*s.*	0	14	0
59*s.* — 60*s.*	0	13	0
60*s.* — 61*s.*	0	12	0
61*s.* — 62*s.*	0	11	0
62*s.* — 63*s.*	0	10	0
63*s.* — 64*s.*	0	9	0
64*s.* — 65*s.*	0	8	0
65*s.* — 66*s.*	0	7	0
66*s.* — 69*s.*	0	6	0
69*s.* — 70*s.*	0	5	0
70*s.* — 71*s.*	0	4	0
71*s.* — 72*s.*	0	3	0
72*s.* — 73*s.*	0	2	0
73*s.* and upward	0	1	0

"*Barley.*—Whenever the average price of barley, made up and published in the manner required by law, shall be for every quarter

	£.	s.	d.
Under 26*s.*, the duty shall be for every quarter	0	11	0
26*s.* and under 27*s.*	0	10	0
27*s.* — 30*s.*	0	9	0
30*s.* — 31*s.*	0	8	0
31*s.* — 32*s.*	0	7	0
32*s.* — 33*s.*	0	6	0
33*s.* — 34*s.*	0	5	0
34*s.* — 35*s.*	0	4	0
35*s.* — 36*s.*	0	3	0
36*s.* — 37*s.*	0	2	0
37*s.* and upward	0	1	0

"*Oats.*—Whenever the average price of oats, made up and published in the manner required by law, shall be for every quarter

	£.	s.	d.
Under 19*s.*, the duty shall be for every quarter	0	8	0
19*s.* and under 20*s.*	0	7	0
20*s.* — 23*s.*	0	6	0
23*s.* — 24*s.*	0	5	0
24*s.* — 25*s.*	0	4	0
25*s.* — 26*s.*	0	3	0
26*s.* — 27*s.*	0	2	0
27*s.* and upward	0	1	0

"*Rye, Pease, and Beans.*—Whenever the average price of rye, or of pease, or of beans, made up and published in the manner required by law, shall be for every quarter

	£	s.	d.
Under 30s., the duty shall be for every quarter	0	11	6
30s. and under 33s.	0	10	6
33s. — 34s.	0	9	6
34s. — 35s.	0	8	6
35s. — 36s.	0	7	6
36s. — 37s.	0	6	6
37s. — 38s.	0	5	6
38s. — 39s.	0	4	6
39s. — 40s.	0	3	6
40s. — 41s.	0	2	6
41s. — 42s.	0	1	6
42s. and upward	0	1	0

"*Wheat Meal and Flour.*—For every barrel, being 196 lbs., a duty equal in amount to the duty payable on 38½ gallons of wheat.

"*Oatmeal.*—For every quantity of 181½ lbs., a duty equal in amount to the duty payable on a quarter of oats.

"*Maize or Indian Corn, Buckwheat, Bear or Bigg.*—For every quarter, a duty equal in amount to the duty payable on a quarter of barley."—(*Johnson's Encyclopædia.*)

CORN, EGYPTIAN. See *Egyptian Corn.*

CORN MOTHS. See *Grain Weevils.*

CORN SALAD. *Fedia olitoria.* Lamb lettuce. It is a mucilaginous, pleasant herb, esteemed for the early period it is found in market. Sow the seed in drills six inches apart; weed carefully. The seeds are small and light; one pound serves for a quarter of an acre. They are sown in August or September, on clean, rich land, covered with straw during cold weather, and brought out at the earliest period in spring. It might be advantageously cultivated for soiling, either sown late for spring or very early for summer; or it may be raised as a summer salad by sowing in March.

CORN-SHELLER. See *Sheller.*

CORNEA. The transparent membrane in front of the eye. Any opacity injures vision; it should be carefully treated by bleeding and blisters.

CORNS, IN HORSES' FEET. This disease is produced by some hard substance pressing on the sole at the quarters, as from shoes left on till the heels become buried in the hoof; the fibrous substance which lies between the sensible foot and the absolute horny hoof becomes inflamed by the pressure, and the inflammation produces a hardness of the spot, similar, if I may so express it, to a knot in a piece of soft timber. Palliate the evil as well as you can by keeping the hoof constantly pared away between the corn and the ground, but do not wound in your vain endeavours to cut it out; avoid the hot irons, &c.; let a bit of sponge be softly put in, merely to keep out gravel and keep the spot moist; and when the season arrives, turn the horse out without any shoes into a soft, marshy place, where his feet must be in a constant moist state for three months at least; by that time the hoof will be altogether renewed, the diseased part will have grown out, and if there is no new injury, there will be no new corns.—(*E. Maunsell.*)

COROLLA. The coloured part of flowers, usually. If there be no green calyx, the coloured envelope is called a *perianthium.* The corolla is either in one piece, or *monopetalous*, or in many, *polypetalous.* The leaflets or parts are also called *petals.* Many natural families are easily determined by the figure of the corolla, as the Convolvulaceæ, Salviaceæ, Rosaceæ, &c. See *Botany.*

CORONET BONE. The second of the consolidated phalanges of the horse's foot.

CORROSIVE SUBLIMATE. A white crystalline salt, the chloride of mercury. It is a fearful poison, one to three grains producing death. The antidote is, abundance of white of egg given internally. A weak solution is occasionally used to destroy vermin and preserve wood, but it is too dangerous to be trifled with.

CORRUGATE. To wrinkle. The folds on the skin of some animals are called corrugations.

CORTICAL (from *cortex, the bark*). Relating to the bark.

CORUNDUM. A class of extremely hard crystalline minerals, composed of nearly pure alumina, as the sapphire, ruby, and emery.

CORVUS. The generic name of the crow and raven. They are omnivorous or carnivorous.

CORYMB. A bunch of flowers, the lowest flower stalks of which rise as high as the uppermost.

CORYZA. A running from the nose.

COSMOGONY (from *κοσμος*, *world*, and *γονος*, *birth*). The speculations concerning the origin of the earth.

COSTATE (from *costa*, a rib). Ribbed. In botany this term is used to designate the bundles of woody fibre in leaves, also called nerves and veins. The numerals are often prefixed, as *tricostate*, with three ribs.

COSTIVENESS. Want of proper motion in the bowels. Glauber salts, Epsom salts, and aloes are useful purges.

COTTAGE. A small, low residence, often highly adorned, or *ornée*. The following from Mr. Ellsworth's Reports on building cheap Cottages will be valuable:

"After selecting a suitable spot of ground, as near the place of building as practicable, let a circle of ten feet or more be described. Let the loam be removed, and the clay dug up one foot thick, or, if clay is not found on the spot, let it be carted in to that depth. Any ordinary clay will answer. Tread this clay over with cattle, and add some straw cut six or eight inches long. After the clay is well tempered with working it with the cattle, the material is duly prepared for the making of brick. A mould is then formed of plank, of the size of the brick desired. In England they are usually made eighteen inches long, one foot wide, and nine inches thick. I have found the more convenient size to be one foot long, seven inches wide, and five inches thick. The mould should have a bottom. The clay is then placed in the moulds in the same manner that brick moulds are ordinarily filled. A wire or piece of iron hoop will answer very well for striking off the top. One man will mould about as fast as another can carry away, two moulds being used by him. The bricks are placed upon the level ground, where they are suffered to dry two days, turning them up edgewise the second day, and then packed up in a pile, protected from the rain, and left to dry ten or twelve days, during which time the foundation of the building can be prepared. If a cellar is desired, this must be formed of stone or brick, one foot above the surface of the ground. For cheap buildings on the prairie, wood sills, twelve or fourteen inches wide, may be laid on piles or stones. This will form a good superstructure. Where lime and small stones abound, grout made of those materials (lime and stones) will answer very well.

"In all cases, however, before commencing the walls for the first story, it is very desirable, as well in this case as in walls of brick, *to lay a single course of slate*; this will intercept the dampness so often rising in the walls of brick houses. The wall is laid by placing the brick lengthwise, thus making the wall one foot thick. Ordinary clay, such as is used for clay mortar, will suffice, though a weak mortar of sand and lime, when these articles are cheap, is recommended as forming a more adhesive material for the plaster. The wall may safely be carried up one story, or two or three stories; the division walls may be seven inches, just the width of the brick. The door and window frames being inserted as the wall proceeds, the building is soon raised. The roof may be shingles or thatch: in either case *it should project over the sides of the house, and also over the two ends, at least two feet, to guard the walls from vertical rains*. The exterior wall is plastered with good lime mortar, and then with a second coat pebble-dashed. The inside is plastered without dashing. The floor may be laid with oak boards, slit, five or six inches wide, and laid down without jointing or planing, if they are rubbed over with a rough stone after the rooms are finished. Doors of a cheap and neat appearance may be made by taking two single boards of the length or width of the doors; placing these vertically, they will fill the space. Put a wide batten on the bottom and a narrow one on the top, with strips on the side, and a strip in the middle. This door will be a batten door, but presenting two long panels on one side and a smooth surface on the other. If a porch or veranda is wanted, it may be roofed with boards laid with light joints and covered with a thick paper dipped in tar, and then adding a good coat, after sprinkling it with sand from a sand-box or other dish with small holes.

"Houses built in this way are dry, warm in winter and cool in summer, and furnish no retreat for vermin. Such houses can be made by common labourers, if a little carpenter's work is excepted, in a very short time, with a small outlay for materials, exclusive of floors, windows, doors, and roof.

"The question will naturally arise, Will the wall stand against the rain and frost? I answer, They have stood well in Europe, and the Hon. Mr. Poinsett remarked to me that he had seen them in South America, after having been erected three hundred years. Whoever has noticed the rapid absorption of water by a brick that has been burned, will not wonder why brick walls are damp. The burning makes the brick porous, while the unburned brick is less absorbent; but it is not proposed to present the unburned brick to the weather. Whoever has erected a building with merchantable brick will at once perceive the large number of soft and yellow brick, partially burned, that it contains, brick that would soon yield to the mouldering influence of frost and storms. Such brick are, however, placed within, beyond the reach of rain, and always kept dry. A good cabin is made by a single room twenty feet square. A better one is eighteen feet wide and twenty-four feet long, cutting off eight feet on one end for two small rooms, eight feet by nine each.

"How easily could a settler erect such a cabin on the Western prairie, where clay is usually found about fifteen inches below the surface, and where stone and lime are often both very cheap. The article of brick for chimneys is found to be quite an item of expense in wooden houses. In these mud houses no brick is needed, except for the top of the chimneys, the oven, and casing of the fire-place, though this last might be well dispened with. A cement, to put around the chimneys, or to fill any other crack, is easily made by a mixture of one part of sand, two of ashes, and three of clay. This soon hardens, and will resist the weather. A little lard or oil may be added, to make the composition still harder.

"Such a cottage will be as cheap as a log cabin, less expensive than pine buildings, and durable for centuries. I have tried the experiment in this city by erecting a building eighteen by fifty-four feet, two stories high, adopting the different suggestions now made. Although many doubted the success of the undertaking, all now admit that it has been very successful, and presents a convenient and comfortable building, that appears well to public view, and offers a residence combining as many advantages as a stone, brick, or wooden house presents. I will add what Loudon says in his most excellent work, the *Encyclopedia of Agriculture*, p. 74 and 75:

"'The great art in building an economical cottage is to employ the kind of materials and labour which are cheapest in the given locality. In almost every part of the world the cheapest article of which the walls can be made will be found to be the earth on which the cottage stands, and to make good walls from the earth is the principal art of the rustic or primitive builder. Soils, with reference to building, may be divided into two classes: clays, loams, and all such soils as can neither be called gravels nor sands, and sands and gravels. The former, whether they are stiff or free, rich or poor, mixed with stones, or free from stones, may be formed into walls in one of these modes, viz., in the pisé manner, by lumps moulded in boxes, and by compressed blocks. Sandy and gravelly soils may be always made into excellent walls, by forming a frame of boards, leaving a space between the boards of the intended thickness of the wall, and filling this with gravel mixed with lime mortar, or, if this cannot be got, with mortar made of clay and straw.

"'In all cases, when walls, either of this class or the former, are built, the foundations should be of stone or brick, and they should be carried up at least a foot above the upper surface of the platform.

"'We shall here commence by giving one of the simplest modes of construction, from a work of a very excellent and highly estimable individual, Mr. Denson, of Waterbeach, Cambridgeshire, the author of the Peasant's Voice, who built his own cottage in the manner described below:

"'*Mode of building the Mud Walls of Cottages in Cambridgeshire.*—After a labourer has dug a sufficient quantity of clay for his purpose, he works it up with straw; he is then provided with a frame eighteen inches in length, six deep, and from nine to twelve inches in diameter. In this frame he forms his lumps, in the same manner that a brickmaker forms his bricks; they are then packed up to dry by the weather; that done, they are fit for use, as a substitute for bricks. On laying the foundation of a cottage, a few layers of brick are necessary, to prevent the lumps from contracting a damp from the earth. The fire-place is lined and the oven is built with bricks. I have known cottagers, where they could get the grant of a piece of ground to build on for themselves, erect a cottage of this description at a cost of from £15 to £30. I examined one that was nearly completed, of a superior order: it contained two good lower rooms and a chamber, and was neatly thatched with straw. It is a warm, firm, and comfortable building, far superior to the one I live in; and my opinion is that it will last for centuries. The lumps are laid with mortar, they are then plastered, and, on the outside, once roughcast, which is done by throwing a mixture of water, lime, and small stones against the walls before the plaster is dry, which gives them a very handsome appearance. The cottage I examined cost £33, and took nearly one thousand lumps to complete it. A labourer will make that number in two days. The roofs of cottages of this description are precisely the same as when built with bricks or with a wooden frame. Cow-house sheds, garden walls, and partition fence are formed with the same materials; but in all cases the tops are covered with straw, which the thatchers perform in a very neat manner.'"

COTTON. The hairs surrounding the seeds of several varieties of *Gossypium*, which are cultivated for the staple in the Southern States of America and elsewhere.

Varieties.—The most common is the green seed (*G. herbaceum*) or upland cotton. The black seed, or Sea-Island, is of longer and finer staple, and supposed to be a variety of *G. arboreum*; it rises often to eighteen feet, and bears well for four or five years. The *Nankin* is the variety suited for the manufacture of the imitation nankin. The Mexican and Pettit Gulf are also upland kinds, and in great favour, especially the last; they are varieties of *G. hirsutum*. Aldridge or Okra cotton is a new Alabama variety, growing with very short stalks, tall, and yielding largely.

Cultivation.—The following by Dr. Philips, from the American Agriculturist, gives a full account of the management of the upland cotton:

"If the land was in corn or cotton the previous year, I run off the rows in the old water furrow with a short plough, this year using two horses to it, and running deep. With a turning plough I then throw to this two furrows, one from each side, intending to reverse the last beds.

"I leave the ground in this condition

until a day or two before I wish to plant, and then break out the entire surface between the rows and the balk; my reason for so doing is, that the cotton plant grows off faster on a bed of some firmness; the radicle, or future root, will die oftener on a light surface than when on hard earth, if not so hard that it cannot penetrate; and by breaking out the middle late it leaves the bed fresh, except a narrow strip on the top, which is cleaned off by planting, which gives the plant an even start with grass and weeds.

"I begin to plant during the first fine weather after the 20th of March, though usually not before early in April, some of my neighbours even earlier than the 20th some seasons; I prefer to be a few days later, and have all business well up, than to haste in planting, and probably get a bad stand from cold, and part of the ploughing to be jumped over.

"I direct the cotton seed to be hauled out, and dropped in two or three heap-rows across the rows, at convenient distances, and in sufficient parcels; practice gives the hands a pretty correct idea how much is required. I usually measure enough for the first row, or an acre, seldom planting over two bushels myself, and often not over one, especially if the seeds be bought. If the first furrows have been settled by heavy rains, are rough, or have many cotton stalks on the row, an iron tooth harrow should be run over them, drawn by one horse, and with the row; this cleans off the row, and leaves it in fine condition for planting.

"I strike out the furrow for planting with an opener. I am very particular to open the furrows as straight as possible, if on level land; or a regular curve, if on hilly or rolling land. The sower now follows with seed in an apron, and scatters them along in the narrow furrow by shaking the hand, so as to cause each seed to fall separate, if possible. This furrow being from one half to three quarters of an inch deep, cannot be covered deep, which would be an injury, seed coming up with more certainty if lightly covered, the nature of the seed requiring the leaves, which are folded or rolled up with the radicle, or root, in the centre, to rise up before the plume or future stalk can start. The seed is well covered.

"I prefer planting about one half the cotton crop some ten days before the remainder, that too much necessary work will not be required at the same time; if a rainy spell of weather now, or any other backset should cause detention in working over the first time, grass and weeds will have taken such hold, that the farmer will find as hard work as in fighting fire; but if only the one half be planted first, the last half will not be pressing. I plant upland at four feet apart between the rows; 2d low ground at five feet distance. Any farmer will find there is very much to be gained by putting his land in fine order before he plants; even if a few days later planting than his careless neighbour, he will soon overtake him in cleaning his crop; besides, his crop is not checked in growth; and he would do well to so pitch his crop that his corn could get one working before his cotton would require it.

"Before giving you the cultivation of the plant, I will describe the seed that I have found to be the best, not only in producing, but in gathering the largest weights per hand. The seed is covered with a short, perfectly white furze, called Mexican; when fresh it is small, but, after being cultivated in the United States, it becomes longer, gradually losing the white fibres, or changing to a germ. The Pettit Gulf seed is the same, only it is carefully selected and kept pure by the planters in the vicinity of the gulf hills near Rodney, this part of the Mississippi River being called Pettit Gulf. This cotton not only produces more, but the bowls (that contain the cotton and seed) open out wider, and it is therefore easier gathered and picked.

"Many persons, in circling their hilly land, do it a greater injury than in ploughing up and down the hills, because their furrows being inclined, the water has only a longer distance to flow, thus accumulating in quantity, velocity, and force; whereas, if they were correctly run off, the water should lie in the furrow as on level land. In doing this, the curve should be as regular as the nature of the land will permit, for the purpose of admitting the ploughs to be run close up to the plant, which could not be if in a zigzag course.

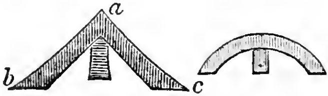
"If the cotton seed be moistened and rolled with ashes and earth, so that the lint or furze be compressed, the moisture of the earth being thus brought directly in contact with the hull or seed, it will vegetate earlier, and will require less seed per acre.

"I throw up my cotton bed as flat as I can to break out deep, and leave the water furrow well open, thus permitting the superfluous water to steep from the bed, and the earth to become warmer, this being necessary to the quick growth of the plant.

"*Cultivation.—Implements.—Scraping* cotton (it is termed *shaving* by tobacco growers) is merely taking off with a hoe the surface of the hill or bed, so as to leave a clean surface; unless this be done well, whether grass or weeds be in sight or not, there will be a quantity of them before the crop can be worked over again.

"A *bull-tongue* plough is about four inches wide, shaped somewhat like the shovel plough, and used on the same stock. I use a *narrow shovel* about six inches wide, also a shovel of the usual width; the first is used when the crop is young, likewise the bull-tongue. The *harrow* is a triangular frame of white oak, three by four stuff, with nine iron teeth, straight, twelve inches long, and made of three fourth inch square bars.

"The *sweep* is the same described by Dr. Cloud, though I prefer the semicircular shape, thus, because it is not so liable, in striking a cotton-stalk or stick, to glance off and injure the cotton; it should be made with cutting edge level, and laid with steel, the back edge raised, so that when the earth falls over, it falls to pieces; the ploughman should carry a file, and be required to keep the sweep sharp.



Cotton Sweeps.

"The *double shovel* is a plough with two moulds; I prefer the moulds of a parallelogram shape, and twisted so as to throw the earth all one way: see a cut of the stocking of one in vol. ii., old series, of the American Farmer, for Sept. 1, 1820.

"The *scraper* is an implement I have tried to have constructed, so as to shave off the bed each side of the cotton plant, leaving four inches or less of the former surface for the hoe hands to clean. I think the difficulty in those formerly used was, want of weight to steady them.

"Our usual scraping is after the plough, then a turning plough goes ahead with the bar next to the row, throwing the earth from the plant to the middle of the row, and in consequence of having to run two or three inches deep, we dare not run near the plant, owing to the bed crumbling down, and the danger of covering the plant by the earth falling from the plough. I am as particular in this part of our labour as is possible, superintend it in person all the day, requiring of the hands to chop through the row, leaving one or more stalks, and cleaning the side of the plants next to hand, then another stand, of a stalk or more, and so on, thus leaving cotton plants about the width of the hoe apart; if the same hand cleans the whole row, he will come back on the other side, cutting up all but one stalk in each bunch, and cleaning the row next him as before. I usually put two on a row, the best hand chops through the row on his side, the other reduces to a stand a single stalk, and cleans the remaining side; I have now really a double stand, that is, twice as many stalks as I design to remain, thinking it prudent not to reduce to a stand, as casualties and carelessness may by chance destroy a stalk or two; and being not over two or three inches high, and ten to twelve inches apart, they do not injure each other. When I use the scraper, there is so little hoe work, that each hand is required to clean the row at one time by chopping through to himself, sweeping off the side of the plants, then with a push of the hoe he cleans the opposite side of the stalks, and reduces to a single stalk at the same motion. Our usual work is three quarters of an acre per hand; but with the scraper, and earth in the same condition, from one to one and a quarter of an acre is as easily done; this is when the crop is got into in due time, which I make a point of doing as soon as I have what I consider a full stand up, never waiting for height or age of it, and only when too cold. On referring to my farm-book, I find I commence reaping from fifteen to twenty days after sowing, owing to the season, and whether earlier or later sown; if the seed be sown early, it is the longer period, the earth being cool, and the sun not powerful enough at this season to warm it.

"As soon as I can return for other business, say in ten to fifteen days at the outside, I throw earth to the plant with the bull-tongue plough, running near and deep, and with any ordinary attention the plant is moulded well with fine, light earth; the sooner this can be done the better, the light earth serving to protect the stem of the plant, the furrow to drain off moisture and loosen the earth, and to give warmth. The plant being thus stimulated, if the weather be not too cold, will resume its green colour if it has turned yellowish, and commences growing; the last half of cotton requiring working, and if rain falls about this time, it may not be possible to get into it earlier than ten days, but at all events we should do so some five days before hoe hands go into it to clean with the hoe. The hoe follows this moulding with the bull-tongue, levels the earth around the plant, and cuts up what grass and weeds there may be present. This working will take us into May, when our heavy rains are over, and when the plant begins to grow off; if I find the earth to crack or be hard, I follow the hoes, in a few days, with the shovel-plough; if the plant will bear it, the large shovel, if not, the small one, next to the plant, and break out the entire middle deep and thoroughly. This is the only time I ever plough deeper, probably, than two inches after pitching my crop, and I do not use the turning-plough after barring off. If the earth be light and mellow, I use the double shovel-plough, three furrows moulding the plant and sweeping the entire middle.

"At this second working I reduce to a stand, leaving the stalks about twenty to twenty-four inches in ordinary land; on the richer land, from two feet to thirty or even thirty-six inches. After this working I keep the earth stirred with a cultivator, or sweep, or double shovel, or harrow, keeping the bed of the row or drill free from weeds and grass, throwing a little earth at each working to the plant, but not enough to be called a ridge.

"I give the crop as many and as frequent stirrings as I am able, seldom less than three or four, with the hoe and plough each, making it a point to keep the ploughs in advance, unless an unfavourable season, when the earth is rather wet to plough, or grass has grown too fast; I then reverse it. The object in keeping ploughs and hoes several days apart is to give a chance for grass to die, so that what has not been killed or covered by ploughs can be cut out with hoes.

"I endeavour to have my land in good order before planting; plough as deep as my horses can pull the plough, and commence to clean my crop before grass has got started, and by frequent stirring keep the crop entirely under my control. I have tried all the plans (except Dr. Cloud's, and intend to give that a trial) of planting and cultivating cotton, and think I can make as much on the same land with those implements that merely stir the surface as others do with the turning or shovel plough, and can, with the same labour, certainly cultivate more. I cannot perceive that any labour will be saved on the same space of land by manuring, as the same acre will require the same work; but the plant, by being warmed with the manure, will grow off faster, and if the crop can be ever doubled on an acre, it will require only half the number of acres for cultivation.

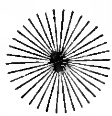
"I may err, as we all are subject to error, especially in being wedded to our peculiar mode of practice; but I think all practical planters will agree with me that the first, and often the second working of cotton, must be slow and tedious, even should the planting be in May. It is impossible that the plant should grow off until the fine roots or spongioles have formed around the top roots to nourish the plant; in the mean time the fibrous rooted plants are growing; we must therefore work early, and every one who has followed hands knows there is little dependance on covering grass; it must be cut up. I therefore think we must scrape.

"My hoes are home-made, the blade entirely steel; I have some here that have been used for the past four years, and they have been used for cutting down sprouts as well as cutting up grass and weeds. My foreman of the crop is furnished with a flat file, and is required to keep the hoes sharp.

"I now sum up, commence cleaning the cotton early, clean it well, return as soon as possible, throw earth or mould to the young plant; if the earth be hard, give a thorough ploughing; keep the earth light and mellow, and the plants clear of grass and weeds.

"*Gathering and Drying.*—After my crop has grown so large as to meet in the row, or to be injured by the plough, I have the grass chopped out with the hoe, especially if there has been rain, for then there springs up a grass called by the opposite names of sour or saltpetre grass; not that I fear any injury to the crop, only as furnishing more trash to get into the cotton when gathering, or keeping the earth wet in the mornings by dews. I forthwith prepare for gathering cotton any leisure time, such as making baskets, sacks, cleaning up gin-house, &c.

"In all this country each hand has a cotton sack and cotton basket for picking; the first made out of stout, yard-wide Lowell goods, by cutting off one and a third to one and a half yards, doubling, and sewing one side and end. On the open end attach a strip of cotton doubled, long enough, when over the shoulder, to keep the sack off the ground when standing erect, this is sewed on each side, so as when the right arm and head are passed through, similar to the belt of the bayonet or broadsword, the weight rests on the left shoulder, and the sack against the right hip. When picking, the cotton is placed in this sack until full, which will weigh from fifteen to twenty pounds, and then emptied into the hamper or basket, placed in a central part of the day's picking. This is made of young white oak, some three to five or six inches in diameter, growing in low ground, by cutting off a piece about seven feet long, quartering, and then splitting into *splits* about three quarters to an inch wide, and as thick as a case-knife blade, and ribs somewhat thicker. Take, according to size of basket wanted, some fifteen to twenty-two or twenty-three of these ribs, and lay them on the ground crossing each other thus,



and commence weaving in the splits as near to the central point as possible, by fastening to the bottom rib first, running over and under until all round; insert an odd rib, for fifteen or twenty will give an even number of ribs, each long one making, in fact, two, and, if an even number, the splits will round all alike; but by having an odd one, the rib that was outside comes next inside, &c. After the bottom is filled up the size wanted, double the ribs over on the bottom, press on them with the foot all round until they will assume, more or less, an erect position, then continue around until the proper height. Now double down the rib so as to enclose the last split, and run the end down into splits, so as to make fast. Get out now two pieces of the white oak, about one third of an inch thick, take off the corners with a drawing knife, put one on the inside, the other outside of the last split around the top of the basket, and wrap it well with thin, narrow splits, over and under the last split. This basket should do for two seasons; the bottom of my largest is about twenty-seven inches across, and about two feet high, will hold about 150 pounds of cotton, or three bushels of shelled corn in the ear.

"The next thing is cotton-scaffolds for sunning the cotton; I only use the shed attached to my gin-house, sixty-two feet long and twelve wide. The best made use of by our neatest planters are made of plank, attached with hinges (like a folding-leaf table reversed), and resting on a framework, so that at night, or a rain threatening, the leaves can be folded up and shelter the cotton. The first of these was described to me ten years ago by the late Mr. William Bacon, who was at that time the most systematic cotton planter I knew, a Northerner. Other kinds of scaffolds are made by cutting cane about five to six feet long, and weaving together with linn bark, of a tree called here linn or wahoo, and laid crosswise on stakes and poles. Others split out boards.

"The gin-house now undergoes a rigid examination. The gin-stand should be sent off to the gin-wright, if necessary; the band be put in order, which should have been well greased and hung up out of the way in the winter; the running gear trained, plummed, and levelled, and the house again thoroughly cleaned out, as it is presumed it was done when the last season's ginning was done. I use a sixty-saw gin-stand; a light draught for four mules, the running gear being Philadelphia castings for a twelve-foot wheel, fastened to a wooden wheel by bolts and nuts. I could give you a minute description of number of cogs in wheel, and in spur or trundle-head, size of band-wheel, and speed of the saws; but, as I purpose to make an examination into this matter the ensuing month among my intelligent brethren in the southwest part of this state, I will postpone and communicate to you hereafter in the East.

"To make fine cotton, there is certainly much depending on the gin-stand, the speed, &c., in aid of which there are a variety of improvements, as the flue, false grates, and a thrasher, though of these hereafter; for the present, I think the flue will entirely supersede all others. As I think of concluding with my last article, and have yet only given you two pages, I will offer some views I have on the handling of cotton, though their correctness is questioned by many; yet, as account sales are 'stubborn things,' I may be allowed to hold on until there is a demonstration to the contrary.

"Cotton should be gathered from the field as clean as possible, taken to the scaffolds, and dried until the seed will crack when pressed between the teeth, not crush or mash, but crack with some noise. It should be frequently turned over and stirred (all the trash and rotten pods taken out while this is being done), so as to ensure its drying earlier.

"If seeds are wanted for planting, gin the cotton immediately, and spread the seed over the floor some five inches thick, until perfectly dry. If the cotton seed be not wanted, pack the seed cotton away into the house, to remain until a gentle heat is discovered, or until sufficient for ginning; after it has heated until a feeling of warmth to the hand, and it looks as if pressed together, open out and scatter to cool. This cotton will gin faster, have a softer feel, is not so brittle, therefore not so liable to break by rapidity of gin, and has a creamy colour; the wool has imbibed a part of the oil that has exuded by the warmth of seed, and is, in fact, restored to the original colour; for the oil being vegetable, it is dissipated by sun and air, and the colour by moisture (of rain and dews) and light. I have known of a number of sales made of this description of cotton, and even those who are most strenuous against the heating admit it bore a better price. No one supposes if cotton be put up wet, dirty, trashy, with rotton pods, that it is benefited. Having all things ready for picking cotton, I commence, as usual, early, as soon as the hands can gather even twenty pounds each. This is advisable, not only in saving a portion of that from being destroyed if rains should fall, which often do at this season (about the middle of August), but for another reason: passing through the cotton has a tendency to open out to sun and air the limbs that have interlocked across the rows, and hastens the early opening. On low grounds, especially, much loss is incurred in some seasons from the want of the sun to cause an expansion of the fibre within the bowl, so as to cause it to open. The bowl is composed of five divisions, in each of which there is a parcel of cotton wool surrounding each seed, there being several in each *lock* of cotton. When green, these fibres lie close to the seed, and as it ripens, the fibres become elastic, the bowl becoming hard and brownish. The Sea Island has only three divisions, as also the Egyptian, which is only the Sea Island of the best variety, with black seed, smooth, and a yellowish tuft of fibres on the small end; they are both from Pernambuco. Some of the cotton we plant has only four divisions, but I think five generally.

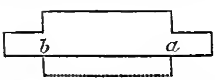
"There is a peculiar art in gathering the cotton from the bowl, which, like handling stock, can only be acquired by practice; many gather equally fast with either hand. The left hand seizes the stem near the open bowl, or the bowl between the two middle fingers, the palm of the hand up; the fingers of the right hand are inserted tolerably low down in the bowl, a finger on each lock of cotton; then, as the fingers grasp it, there is a slight twisting motion, and a quick pull, which, if done well, will extract the contents, the bowl being open, and the bottom of the locks not gummy to adhere. There is a vast difference in hands, not the quickest making the best pickers; a steady, clock-like motion, with some quickness, is necessary to gather fast. A neighbour of mine, when a young man, some ten years since, gathered 400 lbs., which was at that time the best I had known; this has been beaten since, by aiding the hand in emptying his sacks, and almost feeding and watering him while at work.

"After weighing, if the weather be fair, the cotton is consigned to the scaffold, to the care of those who pick out what trash and rotten parts are left. After being dried as said, it is taken into the upper part of the house, and placed over the gin-stand, ready to be turned into the hopper that leads from this place to the gin-stand. My gin-house is 32 by 62, framed, with two floors. Below the first floor is the running gear, where the horses work; in the second story we weigh; on a level is the shed for sunning, fronting the south, in which is the gin-stand at one end, at the other the press. In the garret is carried the seed; cotton over the gin-stand, and the ginned cotton over the press.

"I never pick cotton if wet with rain, but attend to other matters. When the weather is good, I strive to keep every one busy that can gather anything like even a half hand's work. All go out after daylight, but not long, I assure you.

"When I commence ginning, there is a small boy to drive each team, there being four horses or mules, to work in pairs; one hand at the gin-stand, who is kept pretty busy in putting the seed-cotton on to the saws; another hand is required to push the cotton back from the flue of the gin-stand, rake cotton into the hopper, and clear out seed and motes after the gin drops them. With my gin-stand, I have myself ginned four bales per day, and averaged over three bales for a week together; but it requires constant attention. Though the labour is light, yet it requires a good hand to perform it. There is much loss-work in this business; frequently a part of the saws are running through seed, while others are almost choked; again, the roll is not full; again too full. In this way my ginner, though an excellent servant, and named after Cyrus of yore, is sometimes busy ginning out two bales, or even less per day, while I, though naturally lazy, and not disposed to thwart nature in that prerogative, never gin under three bales. The plan is to keep the team steady, and shake the cotton regularly over the roll, so as to keep the roll regularly full. I call the *roll* the cotton in the gin-stand that is turned over and over by the motion of the saws, from which the saws pull off the article known in commerce as cotton.

"The next and last thing is *baling*, which I do by cutting off several pieces from a bolt of bagging, about 4 feet 6 to 8 inches long, the length of the bale being 4 feet 6 inches; I then cut out the bed-cloth, so as to have the heading of each end on it, without wasting, which is done by splitting the first end long enough for head, say 2 feet 9 inches to 3 feet, and cut off one piece; then measure the length of the bale, cut half across, and split the same distance as their end, and cut one end from the bolt (leaving one half attached to the bolt), so as to have both heads on the same side of the cloth, thus: I then



split in two one of the first-named pieces, and sew on to the side from *a* to *b*; this gives the bed-cloth; the two pieces each side of the long middle piece, when cotton is pressed down, serve as half the sides of the bale; the first-named cloth being placed on top of the cotton before pressing, and turned down, is met by these half sides, and, when sewed up, covers the bale; the bed-cloth is laid smooth and even on the bed-block, and the doors of the press fastened over it, when the press is full; one of the first cloths cut, called top-cloth, is stretched under follower and on cotton. My press is a single-screw, inside press; the horse walking adjoining to the walk of the teams working the running-gear of the gin-stand. The bale is pressed above them on the first floor, and the cotton is put in the press on the upper floor. Four hands, or, rather, three hands and a youngster do the pressing, two getting in the box and tramping the cotton down, while the youngster throws in the cotton, and the fourth sews in the head, and prepares a bed-cloth. We press 9 to 10 bales a day, averaging generally 425 lbs., preferring about that weight to any other.

"After running the press down, one hand is employed in tying, while the two others wind up the rope on a windlass, to make it tight round the bale, having grooves in the bed-block and follower large enough for rope to pass through easily; one hand has a needle three feet long, either of white oak or iron wire, through the eye of which is passed a piece of twine, the ends tied together; a loop is formed, the rope passed through, and made fast; the needle is then passed through the upper groove by one hand, another pulls through the opposite side; he then returns it below; the hand that ties pulls through, releases the twine, makes a knot in the end of the rope, passes it over the rope attached to the coil, and makes a single knot; the long end then is passed over a pin in the shaft to which the windlass is attached, then this is turned over and over until tight, the rope cut, and passed under the rope on the bale, sometimes tied, as if knitting a line on to a fishing-hook, and so on until the ropes are all tied. Mine are eight in number; seven, however, are an abundance."

Some planters top the cotton in August.

Cultivation of Sea-Island.—The following is by Mr. Spalding, of Sapelo, from the *American Agriculturist:*

"The Sea-Island cotton was introduced into Georgia from the Bahamas; the seed was from a small island near St. Domingo, known as Arguilla, then producing the best cotton of the Western world. It in no way resembles the Brazil cotton, which is the kidney-seed kind, introduced some years later, and which, after trial, was rejected in Georgia. This seed came in small parcels from the Bahamas in the winter of 1785. It gradually and slowly made its way along the coast of Georgia, and passed into Carolina, from the year 1790 to 1792. The winter of 1786 in Georgia was a mild one, and although the plants of the Sea-Island cotton that year had not ripened their seed—it being a perennial, and subject only to be killed by frost—it started the next season (1787) from the roots of the previous year, its seed ripened, and the plants became acclimated. Many changes have come over this seed since that time, from difference of soil, of culture, and local position; and, above all, from careful selection of seed. But it requires to be discovered that what is gained in fineness of wool is lost in the quality and weight of the product; for, in spite of a zeal and intelligence brought to act upon the subject without parallel, the crops are yearly diminishing, until to grow Sea-Island cotton is one of the most profitless pursuits within the limits of the United States.

"*The Culture.*—When the Sea-Island cotton seed was introduced in 1786, it was planted in hills prepared upon the level field, at five feet each way; but it was soon learned that of all plants that grow, it is, in its first vegetation and early stage, the most tender, liable to suffer by storms, by wind, by drought, and by excess of rain. The quantity of seed was therefore increased, and the plants multiplied, until, as in most other cases, one extreme produced another. For many years, however, among experienced planters, the course is to divide their enclosed fields into two portions, the one at rest, the other in culture.

"*Preparing the Land for the Crop.*—Early in February, any hands not engaged in preparing the previous crop for market are employed in cleaning up the rested fields, and either in burning off the fennel weeds and grass of the previous year, or in listing them in at five feet apart, to serve as the base of the future ridges or bed. There is much difference of opinion upon the subject of burning or listing in; for myself, I am inclined to take the first opinion, believing that the light dressing of ashes the field receives from burning off is more beneficial to the soil than the decay of the vegetable matter, and renders it less liable to produce what is a growing evil, the rust, a species of blight much resembling the rust or blight upon wheat, and which takes place about the same period, just as the plant is putting out and preparing to ripen its fruit.

"*Ridging.*—The land being listed in short lines across the entire field, at five feet apart, the operation of ridging is commenced about the first of March. The ridges occupy the entire surface; that is, the foot of one ridge commencing where the other ridge ends, and rising about eight inches above the natural level of the land, thus presenting a surface almost as smooth, and almost as deeply worked as a garden-bed. This ridging is carried on but a few days ahead of the planting. The ridge, if the operation has been carefully done, is from two to two and a half feet broad at top; it is then trenched on the upper surface with the hoe, six inches wide, and from three to six inches deep, depending upon the period of planting.

"*Planting.*—In the beginning, if the seed is covered more than two inches, the soil will not feel the influence of the sun, and the seed will not vegetate later; that is, in April, up to the first of May, you must give from three to four inches of covering to preserve the moisture, or there, too, you fail from an opposite cause, the wind and burning influence of the sun drying the soil too much for vegetation. In most countries, after sowing the seed the roller is applied; but in cotton planting, in our ridge husbandry, the foot, in covering the seed and pressing down the earth, well supplies its place.

"*Quantity of Seed per Acre.* — A bushel of seed is generally sown to the acre; I believe half a bushel is better; for where the evil comes, whether the worm, or wind, or drought, or wet, there is no security in the many; but, on the contrary, where they come up thin, they soon grow out of the way of injury from any enemy.

"*After Culture.* — The cultivation of Sea-Island cotton is carried on by the hand hoe, and the quantity always limited to four acres to the labourer. The operation of weeding commences as soon as we finish planting, because, in our flat and sandy soils, the grass seed springs with the first growth of the cotton, and by the time we finish planting, say the first of May, what we planted in March requires the hoe. The land is kept in the operation of hoeing and weeding, as far as may be, at its original level, the beds neither increased nor diminished, that rains, which generally fall with beating power and in redundant quantity in the month of August, may as little as possible injure the growing plants, which are then in full bearing. The young cotton is thinned out slowly at from six to twelve inches apart on the ridge by the 10th of June. As soon as the rains commence, which is about the last of July, it is wise to leave nature to herself, and no longer disturb the soil; four hoeings, if well done, and the grass well picked at each hoeing, is enough, nor does any after-growth of grass do injury.

"*Manures and Soiling Stock.*—For ten years past great efforts have been made by the Sea-Island planters in manuring. Much of the alluvion of our salt rivers has been collected, and sometimes placed directly in heaps through the fields at rest, at other times placed in cattle pens, on which cotton seed and all waste materials are strewn, and the cattle pounded upon it. But what is preferred is to pen our cattle near the river at night, and cut salt grass, which covers these alluvion lands, and which is as nutritious as so much clover. Many planters now employ labourers to cut the grass for horses and cattle from the first of May till the last of November; the task required is generally a cord of grass to the hand, and this quantity will answer for ten horses, or fifteen head of cattle, for the night. Benefit has resulted from this course in the ratio of the extent to which it has been persevered in. The last year, Mr. Ruffin discovered that all South Carolina was underlayed by shell marl, at various depths: from my own observation, and inquiries from others, I find the same thing exists in Georgia. Great benefits will result from this, I have no doubt, hereafter, depending much upon the discretion that is used in the quantity applied, which had better be too little, I think, than too much.

"*Amount of Crop per Acre, and Picking.*—It has been stated already that five hundred pounds to the acre are about the medium crop, which, at twenty cents per pound (more than the actual price for the last three years), is to the planter $100 for gross crop; and from this hundred dollars is to be subtracted bagging, freight, expenses of sale, clothing for his people, medical attention, and too often provisions. Is this man to be envied!

"In picking the Sea-Island cotton from the field, the same disproportion exists with his interior brethren as in the other operations on the crop. From the exposure to sea-wind, and the necessity of guarding against every possible injury to the staple, the fields have to be picked over every two weeks, commencing in August and ending in December; so that few planters receive from their people more than twenty-five pounds of cotton per day during the picking season.

"*Preparation for the Market.*—The Sea-Island cotton is now almost exclusively separated from its seed by the foot-gin: two wooden rollers, placed the one over the other in a frame. The rollers are one inch in diameter, about a foot long, and are inserted in an iron journal supported by the frame; upon this journal a fly-wheel thirty inches in diameter is placed; the journal, after passing through the fly-wheel, has a crank, to which the treadle worked by the foot is attached: the fly-wheel is to give a circular motion by the tread of the foot. This gin generally separates twenty-five pounds of cotton per day to one hand. The whole labour of preparing a bag of three hundred pounds of cotton, in sorting the cotton for the gin, in ginning, and in moting after the gin, in again examining it, and in packing, my friend Mr. Seabrook, of South Carolina, puts down at fifty-four days' work. I have estimated it at sixty. Thus a bale of cotton worth $60 has cost, after the cotton has been gathered into the house, sixty days' labour.

"*Locality of Sea-Island Cotton, Original Growth of the Lands, and Aborigines.*—The Sea-Island cotton of the best quality is grown upon islands bounded by the sea on one side, and to the west by salt rivers and salt marsh. These islands extend from Charleston, in South Carolina, to the River St. John's, in Florida, including the whole coast of Georgia. This space may be considered two hundred and fifty miles, between which points there is a safe navigation for open boats, and for dragging vessels of one hundred tons' capacity. These islands were originally almost exclusively covered with live oak, and from them the navy of the United States has been entirely built. These live oak groves once swarmed with Indian tribes, who communed with Sir Walter Raleigh and General Oglethorpe with confidence and friendship. Everywhere you find barrens scattered through the cotton fields, constructed exclusively of oyster shells. Indian bones and Indian pottery, and other remains, tell distinctly here, in ages passed, that the red man lived and died.

"*Healthiness of Climate.*—Volney, in his American tour, says that 'the climate of this coast is the best in the United States, from Rhode Island south,' and this my own experience confirms; carrying more men into old age than any other I know of. Here, too, has been little change of inhabitants for one hundred years past, the son clinging to the home of his childhood and to the grave of his father."

The Gin and Whipper are concisely described by Mr. Spalding.

"The whipper, which is a very necessary instrument in the well preparing of cotton, is made of wood, is a long barrel composed of slats or reeds (or it would be better made of wire) six or eight feet in length, and two feet in diameter, with one end closed and the other open, and is supported at the two ends by feet of different lengths, so that the barrel, in its horizontal position, declines about one foot at the lower end; a hopper containing about a bushel rests upon the upper side of the barrel, at the upper enclosed end of it. This hopper lets the cotton that is to be cleaned fall into the barrel, through which runs in its whole length a shaft, which is turned by the hand by a crank attached to the shaft at one end. This shaft is intersected by rods which reach to within an inch of the barrel. The cotton, as it falls from the hopper, is whirled round by these rods until it escapes at the lower end of the barrel, by which time any sand, or dirt, or leaves, or other matter attached to the cotton has escaped through the spaces intentionally left between the slats or reeds, which constitute the external rim of this barrel or whipper. This whipping was formerly performed as well upon the cotton in the seed as after it was separated from the seed; but the second operation of the whipper has lately been discontinued under a belief that it produced a stringy appearance in the cotton wool.

"The whipping of cotton at its first gathering, and while attached to the seed, is really beneficial, and should never be omitted. When these operations are completed, the harvest may be considered as closed, and the preparation of the cotton for market really begins. Many machines have been designed, and many forms of the same machine adopted, for separating the seed from the Sea-Island cotton, but all of them at last resolve themselves into two wooden rollers turning by opposite movements upon each other. The rollers are from half an inch to an inch in diameter, and revolve from 100 to 500 times in a minute; the whole resolving itself into this simple rule, that the smaller the rollers, and the slower they revolve, the cleaner will be the cotton separated from the seed, because, if the rollers are an inch in diameter, and, above all, if they revolve with a high velocity, they will take in soft seeds, small seeds, and false seeds, or motes, as they are called, and in crushing them in their passage through the rollers will stain and injure the cotton in its appearance.

"Much money has been spent upon costly machines propelled by horses, by water, or by wind, first in the Bahama Islands, and for many years in Georgia and Carolina, but, at last, most of the growers of Sea-Island cotton have returned to their first and most simple machine, to wit, two wooden rollers, kept together by a wooden frame and a square shaft, upon which is fixed a wooden or iron fly-wheel from two to three feet in diameter. The iron cranks which turn the rollers are connected by strips of wood, with a treadle worked by the foot; this treadle runs under the machine, and is connected at the farther end of the floor of the house by sockets, within which it revolves; the man stands, therefore, in the front of the rollers, with a board between him and the rollers, upon which he holds a large handful of seed of cotton, which he presents from time to time to the rollers that are kept in motion by the pressure of the foot upon the treadle; this labour, from habit, becomes easy, as the feet are often changed in the operation. The task expected from the labourer with the machine (which costs, when new and complete, ten American dollars) is from twenty-five to thirty pounds per day. Women, from their careful attention in keeping the rollers, while they revolve upon each other, well supplied with seed cotton, were unquestionably the best ginners, as they are called from the term gin applied to the machine; but in process of time it began to be believed that the continued motion of the feet produced a relaxed system in women, which was likely to lead, in the end, to abortion or miscarriage: men have, consequently, been substituted for this work, one which, being within doors, and exercising both hands and feet without very much labour, is preferred by them to any other in the winter. To prepare the cotton for this ginning, or separation from the seed, when taken from the house where it was put from the field, it is carefully looked over and separated, or sorted, as it is called; the yellow cotton, the motes, any hard cotton that may have passed through the whipper, are separated from the white; this is a work of care and attention, and the future appearance of the cotton much depends upon the manner in which the work is done. Women are employed in this operation seated upon benches, with tables before them; the seed cotton is spread in small parcels, taken out of one basket, examined, and turned over to another, into which the person puts the entire of her day's labour. The quantity required to be thus examined and cleaned in the day by each one is from sixty to one hundred pounds, according to the care bestowed upon the cotton by the grower; after this sorting it is exposed lightly and shortly to the sun, that it may take off any dampness the cotton may have acquired in the house; it is then passed from this drying immediately to the gin, or machine that separates the seed from the wool; after going through the gin, and being separated from the seed, it is again turned over to the women, who are generally in a large room, well lighted with glass windows. They sit with small tables before them, made either with open slats, reeds, or wire, when any crushed seeds, and cotton burned or blackened by the former machine, or motes that have escaped the former searches, are removed; and to have this work well done, thirty pounds is all that is required per day from each woman. After this third operation it is considered ready to be bagged for market.

"As soon as the attention of the Southern States was called to the profitable cultivation of cotton by a few persons along the shores of Georgia and Carolina, the cultivation began to be extended into the interior. The small quantity of cotton that had been grown for domestic uses was exchanged for larger quantities, to be prepared for sale. But the great difficulty to be overcome in the progress to extension was to find out any instrument by which the cotton wool could be separated from the seed.

"By this time various machines had been introduced for ginning the Sea-Island cotton, but all of them ended at last in two rollers revolving upon each other, either longer or shorter, and moving with, some more, some less velocity. Those rollers were but badly adapted to the hairy cotton, or second variety, which soon began to obtain the preference, in the interior of Georgia and South Carolina, over the first or smooth-leaved variety, and merited to obtain that preference, as giving, when separated from its downy seed, a finer and stronger, although shorter fibre, and as perfecting its fruit sooner, but which it was almost impossible to separate with the rollers, because the down or fur upon the seed retained the seed hanging upon the roller, and denied admission to the rollers of the fresh cotton in the seed that was offered. Many plans were suggested, many substitutes for the rollers designed. All succeeded in part, but still they went on slow. Something was desired to do much in a short time; something that was strong enough to travel about without being broken to pieces, and light enough to move with its moving master. At last such a thing was found in Miller and Whitney's gin, probably not the best machine that could have been designed, but so operative to its end, so efficient to its purpose, that it took possession of the whole ground. From thence forward no other machine was sought for, and Miller and Whitney's gin is employed to separate the cotton seed from Virginia to Louisiana, save where the roller gin is used, and its use is now altogether confined to the Sea-Island cotton, whose superior value is supposed to warrant the great increase of labour necessary in that mode of ginning. Miller and Whitney's gin was designed by Mr. Whitney, and executed at the plantation of Mr. Miller, sixteen miles above Savannah, about the year 1795, and it seems to be derived from two machines already used upon cotton, a kind of cylindrical whipper, and the circular cards, before that time introduced in manufacturing cotton, a wooden shaft or roller enclosed within a wooden box. This roller or shaft has, at every inch of its length, a steel blade or saw about a foot in diameter; above these saws is a box containing the cotton in the seed. The box has the bottom of metal slits, through which the saws pass about an inch, and pulling off the cotton, but sometimes cutting the fibres as it passes. This revolving of the saws carries the cotton in the box gradually round, until the seeds contained in the box are freed of the wool attached to them, when it is emptied of the seed and refilled with fresh cotton: it too often leaves some of the fibre behind it, which diminishes the quantity as well as injures the quality, so much so that the estimated difference of the products in these two modes of ginning are, with rollers, 300 pounds to the 1000, and 250 pounds to the 1000 with Miller and Whitney's gin. This gin having, at last, given a cheap and expeditious mode of taking the wool from the hairy American cotton (for a gin that costs ten pounds sterling will clean a bale a day with a single horse acting upon the gin, with a band wheel which any man can make for himself), the cultivation of this description of cotton diverged in all directions around Georgia as the common centre; it went north into the two Carolinas; it went west into the hill country of all the Southern States; it was found capable of adjusting itself to the soil and climate of the interior country, which the Anguilla cotton had not been adapted to; still the fibre of the hairy or short staple cotton is better near the sea than in the interior."

Diseases of the Plant.—Wet soils are peculiarly injurious, producing *rot* and *rust.*

The rot commences with a black or brown spot on the bowl, which, increasing, produces a putrefaction of the whole. It is thought to be a fungus, and to prevail in old varieties during rainy seasons.

Rust is a disease of the leaves and stalk. Spots or blotches of a brown colour appear, which cause the parts to dry up and almost crumble away. It is produced by the *Uredo gossypii,* according to Dr. Leitner.

The *sore shin* is a disease of very young plants in Upper Mississippi, by which the stems are very much injured.

The *louse*, or *Aphis*, is often very destructive; sprinkling with slacked lime and topping would be serviceable.

The *green caterpillar* eats into the bowl, destroying the staple.

The *army worm* is another very destructive insect, of a brown colour striped with white, and devouring the leaves.

The cotton crop is rendered by these causes very uncertain, and peculiarly liable to destruction during wet weather. The introduction of liming is perhaps the best preventive, but the large worms can only be destroyed by burning up the bowls or plants infested, so as to hinder the propagation of the creatures. Notwithstanding all these enemies, two million bales were raised in 1844.

COTTON SEED. The seeds abound in a mild oil, and are very nutritious. A bushel weighs thirty pounds, and yields two and one third quarts of oil and twelve and a half pounds fine meal. They are used as food in the Levant and East. The proportion of oil is great, and readily obtained by pressure; the cake can afterward be used with success in fattening, and as a manure for new crops. To some extent, the whole seed is used for cows and fattening in the South, and is said to afford well-flavoured milk.

COTTON, SPECIAL MANURES. The application of calcareous marls in South Carolina has revived worn lands; salt, also, in moderate quantities, improves the culture, but bone earth will be the most serviceable. Rich lands, or those well manured, yield the heaviest supplies. By Dr. Shephard's analysis cotton wool contains one per cent., and the seed 3·85 per cent. of ashes thus constituted:

	Wool.		Seed.
Lime and Magnesia . .	30·31	—	29·79
Potash and (Soda?) . .	31·09	—	19·40
Phosphoric acid . . .	12·30	—	45·35
Sulphuric acid . . .	1·22	—	1·16
	64·92		95·70

COTTON DYEING. Cotton and linen have nearly the same affinity for dyes, and will be introduced together here. Having been bleached, the first step is to prepare them to receive a good stain. Few colours unite at once to form a permanent dye, and *madder* fret with oil is the most permanent. There are five methods by which cloths are prepared to retain colours.

1st. *Galling.*—Gall nuts or sumach, or a mixture, is prepared for this purpose. Two or three ounces of galls to one pound of cotton are coarsely powdered, put into a copper containing thirty gallons of water for one hundred pounds of cotton, and boiled until the pieces of gall nut feel pasty.

The fire is removed, and the liquor passed through a hair sieve when moderately cool. A portion of the liquor is then drawn into a bath, the yarn or cloth well soaked, wrung or pressed out, and spread to dry. Some fresh liquor is then added to the bath, and fresh cotton used.

When sumach is used, double the weight is added, and the liquor is merely infused in hot water, and not boiled. Where a mixture is used, the galls and sumach are prepared separately and the liquors mixed.

2d. *Aluming.* — This preparation serves for very many colours. Four ounces of clean alum are used for every pound of cotton; the solution is made in a copper of thirty gallons, at 122° Fahrenheit, that amount of water serving for one hundred pounds of cotton. The cotton is introduced into the liquor when at 98° Fahrenheit, well worked, taken out, and wrung or pressed, being placed to dry in the shade. Cotton usually requires a second, and even third immersion before it is fully prepared; it should be kept moist for twelve hours, and dipped only after two or three days from the preceding process. It must be well washed before colouring to remove any uncombined alum. This is so common a preparation that dyers keep the solution in tuns to be drawn off and warmed when wanted. The mordant is sometimes prepared for delicate colours by adding one ounce of carbonate of soda for every pound of the alum. *Acetate of alumina* prepared with sugar of lead, alum, and a little potash, is used to produce fine madder reds, weld yellows, and other brilliant colours: it is used cold, and at 4° Baumé.

3d. *Mordants.* — These are soluble mineral bodies which possess a twofold affinity for the staple and the colour. Acetate of alumina, and iron, and solution of tin are the most important. They are applied to certain parts of the cloth to produce peculiar colours, and are also employed in different degrees of strength in solution for the production of light or deep tints. Thus acetate of iron with madder brings out every shade from pale violet to black. Hence mordants are not only added by bath, but mixed in a paste with starch or gum to hinder them from spreading over the surface of the web. In this way more is used than stains the cloth, and steps are to be taken after the preparation is fixed to remove any part of the mordant that is uncombined; this is done by scouring in a bath containing fresh cow-dung, which takes off the iron or alumina without allowing it to mix with other parts of the web. The process is called dunging.

4th. *Dye baths* are of two kinds.— Colour baths, which are used to extract the colour, except in the case of madder, which is used in powder. Dye baths are the solutions in which the web or yarn is pressed to attain a stain; they usually require a heat of 90° to 100° Fahrenheit, although some are used cold. See the *Colours.*

5th. *Washing after Dyeing.*—This is a delicate operation, as the uniformity of tint depends on it. "A well-planned dye-house should be an oblong gallery, with a stream of water flowing in an open conduit in the middle, a series of dash wheels arranged against the wall at one side, and of dyeing coppers, furnished with self-acting winces or reels, against the other. The washing may be done by hand, by the rinsing machine, or dash wheel, according to the stuff; and they may be stripped of the water either by the jack and pin, by the squeezing roller, or by the press. Wooden pins are placed in some dyehouses on each side the wash cistern or pool. They are somewhat conical, one foot and a half high, three inches and a half in diameter at the base, one inch and a half at the top, and fixed firmly upright, and at a level of about three feet above the bottom of the cistern, so as to be handy." —(*Ure's Encyclopædia.*)

COTTON GRASS. Several species of *Eriophorum* have a small cottony tuft from their summits. They are of trifling importance.

COTTON, WILD. The silk weed (*Asclepias Syriaca*).

COTTON WOOD. The *Populus Canadensis*. See *Poplar*.

COTYLEDON. The seed lobes. Jussieu's followers divide the vegetable kingdom according to the number of parts or cotyledons in any seed. Thus *dicotyledons*, or plants with two seed lobes, are the ordinary inhabitants of the temperate zone. *Monocotyledons* are the palms, grasses, &c., which are most luxuriant in tropical regions, and possess but one seed lobe. *Acotyledons* are the same with cryptogamic plants, and contain no apparent cotyledons.

COUCH GRASS. Several varieties of repent grasses, with perennial stems, are so called, as *Triticum repens*, *Agrostis repens*, &c. There is but one way to destroy them: hoed crops, thorough ploughing, with a harrow to collect the fragments, and heavy liming or salting.

COUGH. Horses and cattle troubled with cough should be sheltered, bran and linseed oil administered, or the bowels moved: bleeding is occasionally necessary.

COULTER. The knife of a plough. It is also a corruption of cultivator, and used to designate a one-pronged cultivator used in the South.

COUNTER. The breast of a horse.

COUPLES. Ewes and lambs are counted by couples.

COUPLINGS. Thongs of leather to fasten two bodies together.

COURT PLASTER. Silk, usually of a black colour, rendered adhesive by the following mixture: one ounce of isinglass dissolved in the smallest quantity of water, and half an ounce of benzoin dissolved in alcohol. This is brushed over ten or twelve times until a sufficient coat is left.

COVER. Any sheltered place in which game can lie hid.

COVEY. A gang of partridges or other game.

COW. "One of the most useful of the domestic animals: her milk is peculiarly adapted to nourish infants and invalids, and requires no preparation to make it palatable or wholesome. In the article *Cattle* we have given an enumeration of the various breeds of cows, and under *Butter* and *Cheese* an account of their principal produce. We shall here confine ourselves to the proper management of a cow, so as to make her most productive, and to the most common diseases to which this animal is subject.

"Where only one or two cows are kept, especially where they are to be maintained on a limited portion of pasture, it is of great importance that a good choice be made when they are purchased or reared. Some breeds, no doubt, are much superior to others; but, as a general rule, there is a better chance of having a profitable cow, if she be reared on the land on which she is to be kept. When the common breed of the country is decidedly inferior, it may be profitable to bring a cow from a distance, in which case it should be from some district of which the pasture is rather inferior to that to which she is brought, or, at least, not better. The best breeds are found in the richest pastures, but they do not thrive on worse. On poor land a small active cow will pick her food and keep in condition, where a fine large cow would starve, or, at least, fall off rapidly. This is particularly the case in the mountains, near the tops of which no domestic animal will live but the goat, and next to it the smallest breed of cows. Where the pastures are poor but extensive, cows give little milk, and the number which can be kept must make up for the produce of each. Where, on the other hand, cows are stalled, and fed on artificial food brought to them in sufficient quantity, large bulky cows give the best return for the food; at least, this seems to be the opinion of the Flemish farmers in general. Where cows pick up the herbage growing by the road-side, in forests, or are tethered on a small portion of clover or lucern, a small lean cow is preferred; and in general the cows commonly met with, and which are bred in each district, seem the best adapted for the mode in which they are fed. Whatever be the breed or quality of a cow, she should always have plenty of food, without which no considerable produce in milk can be expected. This food should be succulent as well as nourishing, or else fat will be produced instead of milk. A cow well fed may be safely milked till within a month of her calving. It is better that she should be dry before the new milk begins to spring in her udder. A little attention will readily prevent her becoming dry too soon, or being milked too long. Heifers with their first calf should be allowed to go dry sooner than older cows, because their growth would be impeded by the double drain of the milk and the calf. It is best to let a heifer go to the bull when nature prompts her to it, provided she be not less than fifteen or eighteen months old; for if they are thwarted in their first heat, they are apt to become irregular ever after; and it is advantageous for a cow to calve regularly at the same season of the year. The best time is May, when the grass begins to be succulent. In populous places, where veal is considered a luxury, the calves are kept and fattened by letting them suck the cows, or by giving them warm milk to drink. Near large towns this is a profitable mode of employing the milk, when it cannot be sold for immediate consumption.

"Her food must be raised in regular succession, and cut for her. The earliest green food is rye, then clover, which may be made so to succeed each other as to give an ample supply. Cabbages, beet root, parsnips, potatoes, and turnips will continue the supply during winter, and the dung and urine of the cow, carefully collected, will be sufficient to keep the land in condition.

"Where cows are allowed to be in the open air, with proper shelter in case of stormy and wet weather, they are subject to few diseases. They must be carefully looked to at the time of calving, but except in urgent cases nature must be allowed to perform her own office. A little common sense and experience will soon teach the possessor of a cow to assist nature, if absolutely necessary; and in case of difficulties the safest way is to call in an experienced person. Drinks and medicine should be avoided; a little warm water, with some barley or bean meal mixed with it, is the most comfortable drink for a cow after calving. The calf, and not the cow, should have the first milk, which nature has intended to purge its intestines of a glutinous substance which is always found in the new-born calf. A very common disease with cows is a disordered function of the liver, producing a yellowish tint in the eyes, and sometimes in the skin. A gentle purge, consisting of half a pound of Glauber salts, an ounce of ginger, and two ounces of treacle, with two quarts of boiling water poured over them, may be given when it is milk-warm, and repeated every other day; keeping the cow warm, if it be in winter, by a cloth over the loins, and in a shed. This will in general restore her health. The symptoms of a diseased liver or lungs in a cow are leanness, with a staring coat, a husky cough with loss of appetite, a difficulty of breathing, and a great diminution in the secretion of the milk. In accidents or acute diseases the attendance of the clever veterinary practitioner is indispensable.

"Attention to food and exercise, giving the first regularly and in moderate quantities at a time, and allowing the cow to use her own judgment as to the latter, are the great secrets of health; and a healthy young cow reared at home, or purchased of a conscientious dealer, will probably live to old age without ever having had any disease. A cow is old and unprofitable when she reaches twelve or fourteen years."

COWAGE. The *Dolichos pruriens*, the pods of which are set with small bristles, which produce great irritation on the skin. It is an exploded remedy for worms, and exotic.

COW-BANE. See *Hemlock*.

COWHERD. One who tends cows.

COWISH, or BISCUIT ROOT. A kind of potato found on the Columbia River.

COW PEA. The Southern bean.

COWPOX. In farriery, a disease affecting the teats of cows. This disease appears in the form of small bluish vesicles surrounded by inflammation, elevated at the edge and depressed in the centre, and containing a limpid fluid. By the use of the virus of this disease has originated the present excellent system of vaccination.

COW-TIE. A provincial term applied to a short, thick hair rope, with a wooden nut at one end and an eye in the other, being used for tying the hind legs of the cows while milking.

COW WHEAT. A very inferior herbage plant of Flanders (*Melampyrum pratense*), with light yellow flowers (see *figure*).

CRAB. The European crab-apple is the *Pyrus malus;* it is larger and tarter than ours, which is the *P. coronaria*, an ornamental tree of fifteen or eighteen feet. The American crab furnishes good stocks for dwarfs, and the fruit makes cider. It would also furnish new varieties if cultivated.

CRACKS IN THE HEELS OF HORSES. See *Horse*.

CRADLE. A frame consisting of five or more long strips of wood, properly curved and bound together, to be affixed to a scythe for cutting wheat, &c. The labourer cuts with a cradle five or six times more than with a sickle.

CRANBERRY. The *Oxycoccus macrocarpus*, a bog plant in the North and West, yielding a large, acid, red berry, containing malate of lime. In preserves and tarts it is highly esteemed, and there is an immense demand for shipping and exportation. They are readily cultivated by transplanting, in spring, the cranberry sods, or selecting plants and transferring them to a light soil, rather moist. The runners can be *layered*, or seed sown in spring. They grow rapidly, covering nearly everything, and are but little subject to the attacks of insects. The plants are set about 18 inches apart, in rows, and kept clean at first.

The yield increases for several years, and becomes as great as 400 bushels the acre in five years, although 200 are a good average. The fruit is gathered by rakes, which serve to prune the plants at the same time. When the berries are intended for keeping, they should be rolled over a gently inclined plane of wood, to remove such as are soft or rotten. They keep well for a year in tight casks, filled with water and headed close. A barrel of four bushels in England sells readily for $20. The fresh fruit commands $1 50 the bushel in New-York.

Several varieties of tall cranberry are found in the United States; as the *Viburnum oxycoccus*, and the *Pambina* of Oregon; but they are not cultivated, the first being unfit for the table.

The English *Oxycoccus palustris* is said by Nicol to be superior to the American; it is readily cultivated on the margins of ponds, and might be introduced into the United States.

CRANK. "A mechanical contrivance for changing a revolving into an alternate motion. An iron axis is bent in some part of its length out of its rectilinear direction. As the axis turns, the bent part describes the circumference of a circle, and gives a reciprocating motion to a piston or rod attached to it."

CRASSAMENTUM. The clot of blood; fibrin, with red globules.

CREAM. The oleaginous part of milk, mixed with some casein.

CREASOTE (from κρεας, *flesh*, σωζω, *I save*). A colourless, spirituous, and oily liquid obtained from wood tar. It is singularly antiseptic, imparting that property to smoke, wood tar, &c. It is of great price, and used chiefly to subdue toothache.

CREMOCARPIUM. A two to five celled inferior fruit, cells one-seeded, indehiscent, dry. When dry, separating from a common axis, as in the *Umbelliferæ*.

CRENATE. The edges of leaves, which are divided into curved notches, are called crenate.

CREPITUS. A crackling noise produced by pressing cellular tissue containing air.

CRESS. *Lepidium sativum*. A small salad herb similar to mustard. It is sown thickly in drills and cut in the first leaf. For a supply, sow every week in good, clean ground.

CRESS, INDIAN. *Tropæolum majus*; Common nasturtium. A brilliant yellow-flowered climbing plant, the fruit of which resembles capers. Sow in April, in good, strong soil and open situation; put out in rows, allowing three inches between each: set sticks for them to climb. They flower in June and July. The fruit, which is admirable for pickling, is taken when full sized, but green, about August. They are put in vinegar or a suitable pickle as soon as gathered. They require little attention when once fairly started.

CRESS, WATER. *Nasturtium officinale*. A creeping, amphibious perennial, indigenous in England. It is of an agreeable flavour, and relished for breakfast. It is cultivated on clear streams one or two inches deep, with a sandy or gravelly bed. The plants are set along the stream in rows about 18 inches apart. They grow readily, and bear cutting very often. If planted near a spring head, they live through winter and remain for many years, affording a great quantity of salad.

CRETACEOUS (from *creta, chalk*). Of the nature of chalk.

CRIB. A feeding-stall, or storehouse for corn.

CRIB BITING. A habit in horses proceeding from derangement of the stomach usually. Straps are used to hinder it, but if the top of the manger be furnished with a roller turning on its axis, they will not be able to bite much of it away.

CRICK. A common term signifying inability to move the muscles of the part, as the neck.

CRICKET. A family of insects resembling grasshoppers, but with less perfect wings. The *Gryllotalpa brevipennis* burrows like a mole, and, with other kinds, lives on the tender roots of grasses, &c. They do injury to melons, pumpkins, &c., and sometimes accumulate in old meadows so as to require extermination. Several *Achetæ*, as the *A. nigra* and *abbreviata*, are abundant, dwelling among grass. They are only to be destroyed by liming, fallows, and hoed crops.

CRINOIDEANS. A nearly extinct race of crustaceous sea animals resembling a lily. The fossils abound in some limestones, as that of Lockport.

CRISTATE (from κερας, *a horn*). Having the appearance of a horn, or crest.

CROP OUT. In geology, the exposure of rocks above the surface.

CROPPING. Gathering a crop. Cutting the ears of animals, as dogs.

CROP, ROTATION OF. See *Rotation*.

CROPS. The produce of the field.

CROSS BREED. The young of animals of different breeds. Sometimes called *a cross*.

CROSS FURROW. A water-furrow running across the ridges or lands. It is often deepened with a spade, and opened with a double-mould-board plough.

CROTALUS. A genus of snakes, including the *C. horridus*, or rattlesnake. They are all furnished with a rattle, and their wounds are extremely dangerous. An instant excision of the part is the most certain remedy. Spirits of hartshorn and wine are necessary to save the patient from sinking.

CROTON OIL. An extremely active purge, obtained from the seeds of the *Croton tiglium*, an Eastern shrub.

CROUP. An acute inflammation of the throat and windpipe, attended with a shrill wheezing and suffocation, occurring in children. It runs its course rapidly, and must be treated with decision. Bleeding, leeches, external irritations, and large doses of calomel are most successful. Hogs are subject to this disease, and are to be treated similarly, blood being drawn freely from the neck, by cutting to the jugular vein.

CROW. *Corvus corone.* Too well known to require description. The crow is a remarkably intelligent and suspicious bird, but easily domesticated, and may be rendered useful on the farm. He destroys insects, mice, rats, and small vermin, but, unfortunately, also delights in chickens, eggs, and corn. His suspicious nature renders it an easy matter to keep him from fields by scarecrows and moveable objects. Corn steeped in stupifying drugs, as hellebore, or in tar and nitre, either destroy him or are rejected. Martins are well known to annoy the crow. Buffon prescribes two curious methods of destroying them: 1st. By wrapping a piece of paper in the form of a long cone, smearing the interior with birdlime, and placing a piece of meat in the bottom: the crow, reaching after it, fits the cone to his head, and becomes blinded; in this dilemma he flies straight upward into the air, until, becoming fatigued, he alights nearly at the spot whence he had flown, and may be shot. The second method is that of pinning a live crow to the ground by the wings, stretched out on his back, and retained in this posture by two sharp, forked sticks. In this situation, his loud cries attract other crows, who come sweeping down to the prostrate prisoner, and are grappled in his claws. In this way each successive prisoner may be made the innocent means of capturing his companions.

CROWSFOOT. Several species of *ranunculas*, which are acrid and poisonous.

CROWS' NET. A net made of fine packthread, used chiefly for catching wild fowl, but which may be employed on newly-sown fields to entrap crows, pigeons, and other birds that destroy grain, or in stubble, where this is sufficiently long to conceal the network.

CROWN OF A LAND. The central part of the ridge.

CRUCIBLE. A chemical vessel used to expose bodies to a strong heat. For coarse purposes, the Hessian crucible, made of sand and clay, is used. Porcelain crucibles are necessary for finer work, and where the platinum will not answer, but are destroyed by fixed alkalies. The platinum crucible is the finest, from the ease with which it may be cleaned and managed, but is unfit for the treatment of lead, arsenic, mercury, and a few other metals which alloy with platinum. A black-lead crucible is used for coarse work, and resists a stronger heat than the Hessian.

In delicate operations the platinum crucible is placed within another of coarse porcelain, or in a muffle.

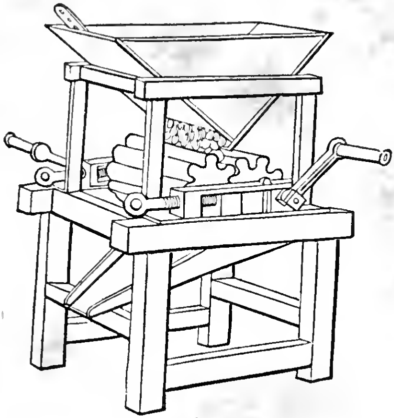
CRUCIFORM, or CRUCIFEROUS PLANTS. *Cruciferæ* (from *crux, a cross*). Plants which have a flower consisting of four petals, arranged as a Maltese cross, as the cabbage, cress, turnip, mustard, radish, &c. They require rich land, are wholesome, abound in pungent oil, and when grown for seed are extremely exhausting. They are essentially sulphur and potash, or soda plants.

CRUOR. The clot of blood.

CRUPPER. The horse's rump; the leather harness which passes under the tail.

CRURAL (from *crus, the thigh*). Belonging to the thigh or leg.

CRUSHERS FOR GRAIN, &c. Mortars, mills on the same principle as the coffee mill, bark mills, and grooved rollers running into one an-



other (*Fig.*), are variously used to crush corn, corn cobs, and roots.

CRUSTACEANS (from *crusta, a hard covering*). A tribe of animals like crabs, lobsters, &c., with a crust, and destitute of vertebræ. The crust contains fourteen per cent. of phosphate of lime; the rest, carbonate of lime and animal matter.

CRYPTOGAMIA (from κρυπτος, *concealed*, and γαμος, *marriage*). An immense tribe of plants, which have no flowers or apparent sexual organs, but produce *sporules* or minute seeds in cases on their sides, backs, or on stalks. Ferns, mosses, fungi, seaweeds, lichens, and the minute parasites which infest plants and dead wood, as rust, mildew, rubigo, &c., are of this tribe.

CRYSTAL (from κρυσταλλος, *ice*). Any transparent solid with a natural and regular geometrical figure.

CRYSTALLINE LENS. The lens of the eye, which refracts light, so as to produce clear vision. It is situated internally, behind the aqueous humour.

CUCUMBER. *Cucumis sativus.* A pleasant but indigestible edible. The varieties are numerous, but the early frame, early green cluster, long prickly, and long green are most cultivated. The West Indian gherkin is another species.

As the cucumber grows so freely in the United States, the process of forcing is much more attended to for early supplies than in Europe.

Forcing.—Begin ten weeks before the fruit is wanted. The short prickly, long green, and white-spined are preferred. Seed should be two or three years old. Sow in pots placed over a warm bed. Water with tepid water, and take care that chilled air does not enter the frame. When the second leaves are expanded, transplant into larger pots; place three together. Carry, when one month old, to the fruiting-bed. The fruiting-bed is made on a dry spot, with fresh dung, well turned and forked, and four feet high. As soon as the bed is settled, and in regular fermentation, add six inches of fine mould, and if it remains mellow it will answer, but if fire-fanged or caked, more will be necessary. Hill the mould to within eight inches of the glass frame, and set three plants from the pots in it, transplanting with the ball of earth: these are enough for one frame. Water with warmed water, and darken until they are well rooted. The temperature is kept from 70° to 80° Fahrenheit, the steam being allowed to escape when it rises. As the heat lessens, add fresh dung outside, cutting away the old. Form a bank two feet wide and a foot high against the back of the frame. Give the plants air whenever an opportunity offers. Water in the morning. Sometimes water in which guano or bird dung has been steeped is used. As the roots enlarge, add fresh, good mould.

Stop the growth of the stems by pinching off the buds at two joints, and in this way keep stopping the lateral shoots; this strengthens the plant and causes it to perfect fruit early. Mind that some female flowers are left, or such as have solid swellings under the blossom, for these only bear fruit. Abercrombie thinks it advisable to pluck the male blossom and shake it over the female, for the purpose of securing a fall of pollen or farina. The fruit is fit to cut 16 to 20 days after setting, and by care may be obtained in succession for two months.

Common Cultivation.—Sow in May in slight hollows, four feet apart; manure the seed beds well with rotten dung: eight or nine seed to the hill. Leave three plants in the hill; hoe and earth up; cut away weeds; a little water in dry weather does good. The soil should be light and mellow. Pickling cucumbers may be planted in July. Select the finest for seed. The fruit is sometimes made to grow in cylindrical moulds of pottery.

Insects injurious to the Cucumber, Melon, &c.—The striped bug. Galeruca vitata. It eats the young foliage and flowers; it is yellow, striped with black.

The Flea Beetle. Haltica pubescens. A small, black, active coleopterous insect, which destroys the small plants.

The Squash Bug. Coreus tristis. A large angular hemipterous insect with brown upper wings and orange belly, collecting in groups under the fruit, and destroying the leaves and fruit of all the cultivated *cucurbitaceæ.*

The black Worm. The larva of a coccinella; it cuts down the young plants, and can only be caught in the morning, as it retires into the earth during the heat of the day.

Several species of aphis annoy the plants. The large insects must be caught in nets or with the hand; soot, tobacco water, solution of whale oil soap; infusion of wormwood, Mayweed, pennyroyal; and slacked lime, are all used with advantage. Placing hens or turkeys with young broods in a coop, and allowing the chickens to run among the vines, is an admirable expedient. All the foregoing insects infest melons, cucumbers, and squashes also.

CUCUMBER-TREE. Some magnolias are so called.

CUCUMIS. The generic name of the cucumber, melon, &c.

CUCURBITACEÆ. A family of plants, mostly vines, monœcious, with inferior fruit, inhabiting warm countries. The melon, pumpkin, cucumber, gourd, squash, colocynth, and bryony are common examples.

CUD. In cattle, the food in the first stomach, which is to be chewed over again and passed into the third to be digested.

CULEX. A genus of insects including the gnat (*C. pipiens*) and similar creatures: it is the type of the *Culicidæ*, which contains *moschetoes*, &c.

CULINARY VEGETABLES. Plants cultivated in gardens, and sometimes in fields, for culinary purposes. They may be classed as leaf plants, such as the cabbage tribe, spinaceous plants, salads, pot and sweet herbs; stalk plants, such as asparagus, tart rhubarb, sea kale, &c.; roots, such as the turnip, carrot, potato, &c.; seeds, such as the pea and bean; fruit, such as the cucumber, pumpkins, squashes, &c.; and the entire plants, such as the onion, leek, mushroom, &c. They may be otherwise arranged, as the cabbage family; the leguminous family; esculent roots; spinaceous plants; alliaceous plants; asparaginous plants; acetarious plants; pot herbs, sweet herbs, plants used in tarts and confectionery, and edible fungi.

CULLET. Pounded glass. It is used in glass-making, for scouring paper, and as a manure. It consists of silicate of soda and lead, and is probably over-estimated as a manure.

CULM. Stems which, like the straw of grain, sustain the flowers at a distance from the leaves. It is also used as a synonyme for anthracite in England.

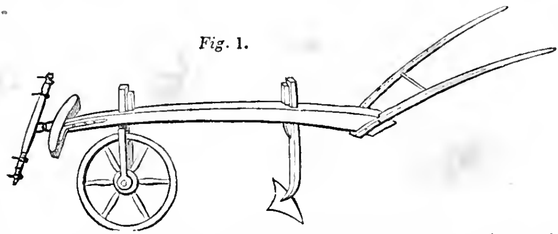
CULMIFEROUS PLANTS. The cerealia and grasses.

CULTIVATOR. The same as a horse hoe. Cultivators consist of one hoe or tine, or many. They are used to loosen the soil in drill husbandry, and pass where the plough would be too cumbrous. They also destroy weeds by scraping them from the surface and cutting their roots. The tines are of every form, either curved forward like a claw, made like a double mould-board in miniature, long and sharp, or like sharp hoes, according to the objects of the farmer. The frame on which they are fastened is like a triangular harrow, and capable of being widened at pleasure. The several kinds of tines should be purchased with the frame, so as to be inserted into the mortices when wanted.

Bement's and *Van Bergen's* cultivators are well known in the Northern States. In Virginia, a strong one-tine, or coulter, is used to prepare new land. The following figures represent simple hoes and the most improved; they are all without patent, being English or Scotch implements.

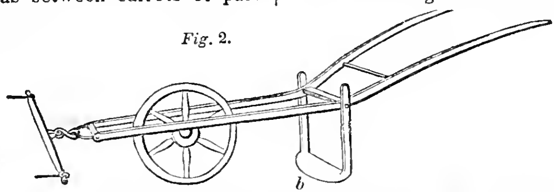
In *Fig.* 1 the hoe is intended for

Fig. 1.



cutting and scraping in a narrow space, as between carrots or parsnips: the wheel regulates the deptn of the hoe. *Fig.* 2 is used to scrape

Fig. 2.



a wide surface, and is valuable in weeding; the iron blade (*b*) inclines downward, so as to cut the soil. These can be made in any village.

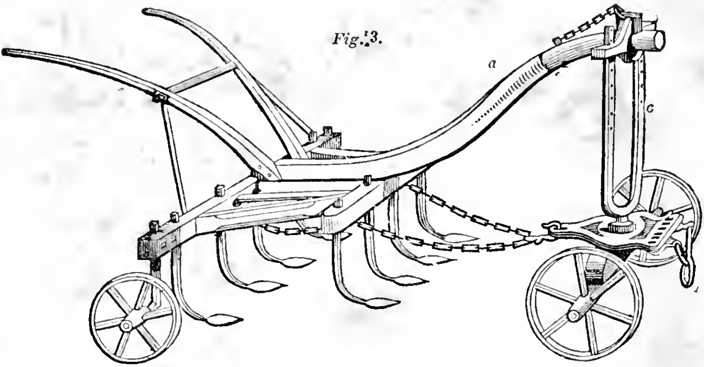
Fig. 3 represents *Weir's* admirable cultivator of nine coulters, or hoes; it may be used to stir the soil or to open drills. The beam (*a*) moves on the support (*c*), so as to regulate the depth of the hoes.

Wilkie's horse hoe and drill harrow (*Fig.* 4) is also a favourite implement; the first three hoes are so fixed as to open drills, and the tines behind scrape the soil to a depth regulated by the grading of the front wheel.

Finlayson's cleaning cultivator or harrow (*Fig.* 5) is entirely of iron; it has the following advantages:

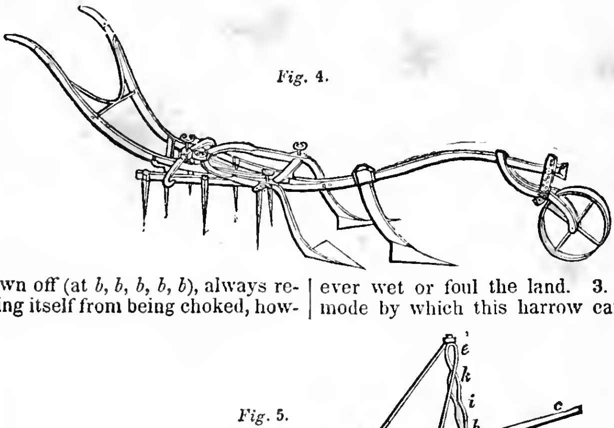
"1. From the position in which the tines are fixed, their points (*a, a, a, a, a*) hanging nearly on a parallel to the surface of the land, it follows that this implement is drawn with the least possible waste of power. 2. From the curved form of the tines, all stubble, couch, &c., that the tines

Fig. 3.



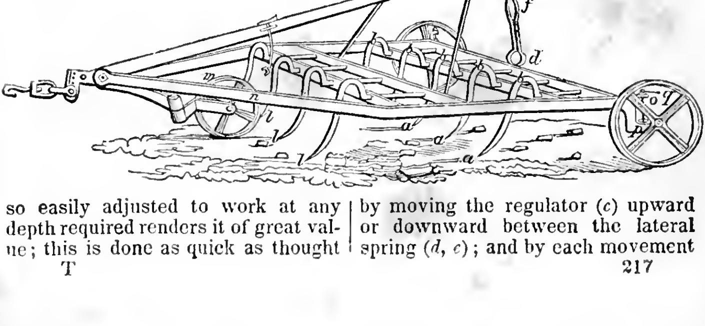
may encounter in their progress through the soil is brought to the surface and rolled up to the face of the tines, when it loses its hold, and is

Fig. 4.



thrown off (at *b*, *b*, *b*, *b*, *b*), always relieving itself from being choked, however wet or foul the land. **3.** The mode by which this harrow can be

Fig. 5.



so easily adjusted to work at any depth required renders it of great value; this is done as quick as thought by moving the regulator (*c*) upward or downward between the lateral spring (*d*, *e*); and by each movement upward into the openings (*f*, *g*, *h*, *i*, *k*) the fore tines (*l*, *l*, *l*, *l*) will be allowed to enter the soil about an inch and a half deeper by each movement into the different spaces, until the regulator is thrown up to *e*, when the harrow is given its greatest power, and will then be working at the depth of eight or nine inches. Also, the axletree of the hind wheels is moved between *o* and *p*, a space of seven or eight inches, by a screw through the axletree, which is turned by a small handle (*q*), so that the hind part of the harrow, by this simple mode, is also regulated to the depth at which it is found necessary to work. 4. When the harrow is drawn to the head or foot lands, the regulator is pressed down to *d*, and the fore wheel (*m*) is then allowed to pass under the fore bar (*n*), by which the nose of the harrow is lifted, and the points of the fore tines (*l*, *l*, *l*, *l*) will then be taken two or three inches out of the soil, which affords the means of turning the harrow with the greatest facility. 5. Being made of malleable iron, its durability may be said to be endless; whereas, if made of wood, the prime cost would be entirely lost at the end of every five or six years. Lastly, the mode of working is so easy, that any boy of ten or twelve years of age is perfectly qualified to manage it."

Cultivators are occasionally called grubbers, scarifiers, harrows, &c., according to the figure of the tines.

Several broad share cultivators for Indian corn, beans, &c., have been recently brought out by Mr. Langdon, which clean a large surface, and, at the same time, pulverize the soil without penetrating deep enough to disturb the growing roots. They resemble double mould-board ploughs.

CULVERT. "An arched channel of masonry built beneath the bed of a canal, for the purpose of conducting water under the canal. If the water to be conveyed has nearly the same level as the canal, the culvert is built in the form of an inverted siphon, and acts on the principle of a water pipe. This word also signifies any arched channel for water under ground."

CUMIN. *Cuminum cyminum.* A plant cultivated in Sicily for its bitter aromatic seeds: used in confections, and to flavour cheese. It is umbelliferous; requires a dry, rich soil; bears the second year, and does not differ in its management from coriander.

CUNEATE, CUNEIFORM (from *cuneus, a wedge*). Used in botany, to describe any surface which is angular, with the length considerably exceeding the width.

CUPEL. "A shallow earthen vessel, somewhat of a *cup* shape, generally made of bone earth. It is used in the assays of the precious metals, which are fused upon a cupel with lead. Cupellation means the refining of gold or silver upon a *cupel*."

CUPPING. In this operation a cup-shaped glass is used, into which the large flame of a spirit lamp is momentarily introduced, so as to expel a great part of its air by dilatation; it is then instantly applied to some part of the body, which is forced into it by the external pressure; and on removing the glass a circular red mark is left, from the propulsion of the blood in the small vessels of the part: this is called *dry cupping*. It is generally followed up by making a number of incisions in the part by means of an instrument called a *scarificator*, from which the blood oozes, and from which a considerable portion may be drawn by again applying the cupping glass. Cupping, when well performed, is not a very painful or disagreeable operation, and is an excellent mode of local blood-letting. When the operator is not dexterous, it is not only painful, but often dangerous in its consequences. The bleeding may generally be easily stopped by a piece of lint or soft rag; but this should be looked after. — (*Brande's Encyclopædia.*)

CUPULIFERÆ (from *cupa, a cup*). A natural order of arborescent or shrubby exogenous plants, inhabiting all temperate and some hot climates. They are distinguished by their amentaceous flowers and peculiarly veined leaves from all European trees; and from other plants by their apetalous calyx, fruit enclosed in a husk or cup; and by their nuts, which contain but one cell and one or two seeds. This order comprehends the oak, hazel, beech, chestnut, and hornbeam, well-known valuable forest trees.

CURACOA. A liqueur which derives its name from the island of Curacoa: it is prepared in great perfection by the Dutch. It derives its flavour from Seville orange peel, with a small quantity of cinnamon and mace.

CURCULIO. A general term in the United States for the coleopterous insects which devour fruits, or the larvæ of which do so. They are particularly destructive to plums, apricots, and peaches, as well as nuts. The introduction of poultry into the orchard, especially hens in coops with broods, hogs, paving the ground, shaking the trees, and other expedients, are used. Destroying every fruit which they cause to fall is useful. But suitable attention to the trees, scraping, cleaning with suds, solution of soft soap and whale oil soap, are quite effective. See *Insects*.

CURD. The coagulum of milk.

CURL. A disease of potatoes, which see.

CURRANT. The white and red are improved varieties of *Ribes rubrum*, the blacks from *R. nigrum*. The most esteemed kinds are the Dutch red and white, white crystal, Champagne, and black Naples. It is propagated by slips, layers, suckers, grafting, and seeds. A warm, loamy, rich soil is best; they thrive in free exposures. They bear on two and three years' spurs; in pruning, cut down new shoots to within three eyes of the starting place. They should be kept open, suckers removed, and not be allowed to branch too low: four feet apart is a good distance for bearing shrubs. The currant is very healthy, but subject to many caterpillars, aphides, &c., which must be destroyed by slacked lime, and keeping the branches clean by a syringe. The fruit makes admirable jelly, wine, and is readily kept.

CURRYING. The preparation of leather by which it is polished and rendered soft. See *Tanning*.

CUSCUTA. The generic name of the dodders.

CUSPIDATE (from *cuspis, a point*). Pointed, a term used in descriptive botany.

CUSTARD APPLE. A West Indian fruit, the *Anona reticulata*.

CUT. An incision, best treated with sticking-plaster only.

CUTANEOUS (from *cutis, the skin*). Relating to the skin.

CUTICLE. The external delicate membrane of the true skin; the epidermis of plants.

CUT WORM. This name is applied to any caterpillar dwelling in the earth, which eats or cuts away young plants of cabbage, corn, beans, &c. They are naked, of a greasy appearance, and ashy green; are only seen above ground before sunrise or in cloudy weather. They abound in lands which are rich, and have remained in grass or clover for a long time, and are referred chiefly to the genus *Agrostis*, especially *A. suffusa, latens, telifera*, but are also the worms of other genera. The moths are large, and of various shades of pink and brown: they are formed in July and August.

Means of destroying them.—Soaking seeds does no good in this case. Working soot, tobacco, ashes, lime, and other noxious substances into the soil around the plants answers on a small scale. Picking them before sunrise is recommended, but is very tedious; young chickens would assist. Wrapping the leaves of other plants about young cabbages, &c., has also answered. But when the soil is infested with these creatures, it is best to add a good salting of 15 or 20 bushels the acre, or 50 bushels of fresh lime; expose it to frost in the fall, and give the worms no rest by frequent stirring of the earth.

CUTTING. When a horse cuts or wounds one leg with the opposite foot. The best remedy is to put on the cutting foot a shoe of even thickness from heel to toe, not projecting in the slightest degree beyond the crust, and the crust itself to be rasped a little at the quarters. This shoe should only have one nail on the inside, and that almost close to the toe. —(*Library of Useful Knowledge.*)

CYANITE (from κυανος, *blue*). A massive and crystallized mineral. It has a pearly lustre, is translucent, and of various shades of blue: it is a silicate of alumina, with a trace of oxide of iron. Only found in primitive rocks.

CYANOGEN (from κυανος, *blue*, and γιγνομαι, *I form*). A gas which burns with a blue flame, the bicarburet of nitrogen; it is a compound radical, forming acids with oxygen (*cyanic*) and hydrogen (*hydrocyanic* or *prussic*). The gas is poisonous: it combines directly with many metals, forming cyanides.

CYANURIC ACID. A product of the action of heat on urea, formula $C_{12}\ N_6\ O_6$.

CYCADEÆ (from *Cycas*, a genus of plants). A small family of dwarf palms which are gymnospermous. The *Cycas circinalis* yields sago.

CYCLOSIS (from κυκλος, *a circle*). A circulation of the elaborated sap in the higher plants in delicate anastamosing vessels. The latex circulation.

CYDONIA. The generic name of the quince-tree.

CYLINDER (from κυλινδω, *I roll*). A solid, the height of which exceeds the diameter, which is constant; it offers a circular section at every part when made at right angles to the axis. As stacks are often nearly cylindrical, their contents may be discovered by the formula for a cylinder: the solid contents are equal to the height multiplied into the area of the base or section.

CYME. An inflorescence: the flower stems spring from one part, but are afterward variously subdivided.

CYNARACEÆ. Plants like the artichoke, thistle, &c., with the flowers included in a scaly *capitulum*, also called a *cynarocephalus*.

CYNIPS. A genus of hymenopterous insects without stings. They insert their eggs in parts of living trees, causing tumours, of which the *gall nut* is a specimen.

CYNOSURUS. A genus of grasses, of which the *C. cristatus* is considered a good sheep grass. See *Grasses*.

CYPERACEÆ (from *Cyperus*, a genus). The tribe of plants consisting of rushes, sedges, and other marsh grasses without nodes or joints. They are of trifling value; the *Cyperus esculentus* of Italy furnishes a sweet nut or tuber.

CYPRESS-TREE. *Cupressus sempervirens*. A hardy shrub, a native of the Levant, growing from fifteen to twenty feet high, which throws out yellow blossoms in May. Its wood is red, very hard, and sweet-scented. It likes a good soil. Its wood, from being sonorous, is used for harps, violins, and other musical instruments. Worms never attack it.—(*Phillip's Shrub.*, vol. i., p. 188; *M'Culloch's Com. Dict.*)

CYPRESSES, AMERICAN. See *Cedar*.

CYPSELA (from κυψελη, *a bee-hive*). A one-celled, one-seeded, indehiscent fruit. An *Achenium*.

CYSTIC (from κυστις, *a bag* or *bladder*). Appertaining to the bladder. *Cystic oxide*, a rare ingredient in urinary calculi.

D.

DACTYLIS. A genus of grasses, of which *D. glomerata*, orchard or cock's-foot, is the only important species. See *Grasses*.

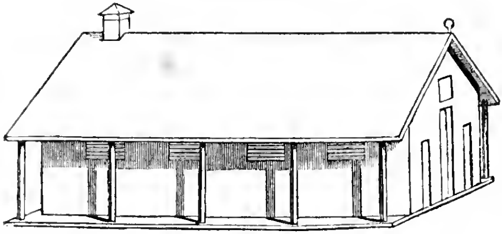
DAIRY. "The name usually given to the place where the milk of cows is kept and converted into butter or cheese.

"A dairy-house should be situated on a dry spot somewhat elevated, on the side of a gentle declivity, and on a porous soil. It should be on the west or northwest side of a hill if possible, or, at least, sheltered from the north, east, and south by high trees. In some countries where there are natural caverns with an opening to the west, and springs of water at hand, the best and coolest dairies are thus prepared by nature. Artificial excavations in the sides of freestone rocks are sometimes formed for the purpose of keeping milk. Where no such natural advantages exist, the requisite coolness in summer, and equal temperature in winter, which are essential in a good dairy, may be obtained by sinking the floor of the dairy some feet under ground, and forming an arched roof of stone or brick. In cold climates flues around the dairy are a great advantage in winter; and an ice-house in warm summers is equally useful. But these are only adapted to those dairies which are kept more as a luxury than as an object of profit. Coolness is also produced by the evaporation of water, an abundant supply of which is essential to every dairy. It is also a great advantage if a pure stream can be made to pass through the dairy, with a current of air to carry off any effluvia, and keep the air continually renewed.

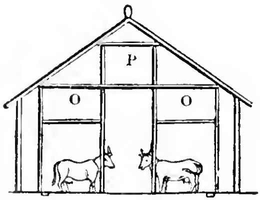
"As the milk suffers more or less from being agitated, or too much cooled, before it is set for the cream to rise, the cow-house or milking-place should be as near as possible to the dairy, or, rather, it should be under the same roof. The milk may then be brought immediately from the cows without being exposed to the outer air. The dairy-house should consist of three distinct apartments below, with lofts and cheese-chambers above. The principal place is the dairy, properly so called, sunk two or three feet below the level of the ground, with a stone or brick bench or table round three sides of it to hold the milk pans. This table should be a little below the level of the outer soil. Airholes covered with wire should be made in the walls a little above, and on the opposite sides of the dairy; and they should have shutters sliding over them to open or shut, according to the weather. The floor should be of stone or paving tiles, sloping gently towards a drain to carry off the water. Great care should be taken that no water stagnates in this drain, which must be kept as clean as the floor of the dairy, and not communicate with any sink, but run out into the open air: a declivity from the dairy is essential for this purpose. If this cannot be obtained, it must run into an open tank, and the water be regularly pumped ont. The windows of the dairy should be latticed. Glazed windows may be added for the winter, but they should always be open except in very hot or very cold weather. There may be shutters to close entirely, but this is not essential. If the windows are made like Venetian blinds, the light will be excluded without excluding the air. The utmost purity must be maintained in the air of a dairy; nothing should enter it that can produce the slightest smell. No cheese or rennet should be kept in it; and particularly no meat, dressed or undressed. Even the dairy-maid should avoid remaining longer in it than is necessary, and should at all times be extremely clean in her person.

"The next important place is a kind of wash-house, in which there is a chimney where a large copper kettle hangs on a crane to heat water in, or milk when cheese is made. Where wood is scarce, and pit-coal is the common fuel, a copper may be set in brick-work with a grate under it. In this place all the utensils of the dairy are kept, and scalded with boiling water every day. It should have an outer door, which may be to the south, and benches outside, on which the pails and other utensils may be set to dry and be exposed to the air. Between the last two apartments may be another communicating with both, and forming a kind of vestibule, where the churning may take place; and over them a cheese-room and lofts, or any other useful chambers. A veranda round the dairy is very convenient, or on three sides at least. It shades from the sun, and adds to the warmth in winter; and the utensils may be dried and aired under it even in rainy weather. The following description of a cow-house and dairy under one roof combines all that is useful, with considerable neatness internally and externally: It is a building about sixty feet long by thirty wide, with a veranda running round three sides of it. The dairy-room is sunk below the level of the soil, and is paved with brick. The sides are covered with tiles, and the arched roof with hard cement. The cow-house has a broad passage in the middle, and the cows stand with their heads towards this passage, which is paved with clinkers or bricks set on edge. Their tails are towards the wall, along which runs a broad gutter sunk six or eight inches below the level of the place on which the cows stand. This gutter slopes towards a sink covered with an iron grate, which communicates by a broad arched drain with a vaulted tank, into which all the liquid flows. The gutter is washed clean twice a day before the cows are milked. The cows stand or lie on a sloping brick floor, and have but a small quantity of litter allowed them, which is removed every day and carried to the dung-heap or to the pig-sties, to be more fully converted into dung. Whenever the litter is removed, the bricks are swept clean; and in summer they are washed with water. The manner in which the cows are fastened is worthy of notice: Two slight pillars of strong wood are placed perpendicularly about two feet distant from each other, so that the cow can readily pass her head between them. On each of these is an iron ring, which runs freely up and down, and has a hook in its circumference: two small chains pass from these hooks to a leather strap, which buckles round the neck of the cow. Thus the cow can rise and lie down, and move forward to take her food, which is placed in a low manger before the two pillars; but she cannot strike her neighbour with her horns. The mangers or troughs are of wood, or of bricks cemented together, and are kept as clean as all the rest of the cow-house. In Switzerland the cow-houses are similar, but there is also a rack, the back of which towards the passage shuts up with a board on hinges. The Dutch mode supplies more light and air to the middle passage; and as the food is given frequently and in small quantities, there is very little waste. The following cuts will give a tolerable idea of the whole arrangement. The food is brought in carts, which are driven at once between the cows. What is not wanted immediately is stored above, whence it is readily thrown down before the cows. Thus much trouble is saved, and one man can feed and attend to a great many cows. From November till May the cows never leave the cow-house. In summer, when the cows are out, if they are in adjacent pastures, they are driven home to be milked; but if the pastures are far off, which is sometimes the case, they are milked there, and the milk is brought home; but this is not thought so good for the butter, which is then always churned from the whole milk, without letting the cream rise. The finest and best flavoured butter is always made from the cream as fresh as possible; and to make it rise well, the milk should be set as soon as it is milked, and agitated as little as possible. The greatest quantity is seldom obtained when the quality is the finest. When great attention is paid to the quality, the milk is skimmed about six hours after it is set; and the cream taken off is churned by itself. The next skimming makes inferior butter. These particulars are mentioned to show the necessity there is of having the dairy as near as possible to the cow-house.

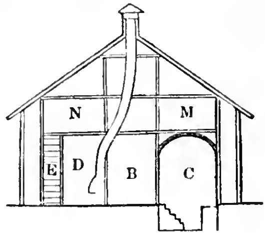
"The utensils of the dairy, such as pails, churns, vats, &c., are usually made of white wood, and are easily kept clean by scalding and scouring. Leaden troughs are used in large dairies; and if they are kept very clean by careful scouring, they answer the purpose better than wood. They may be so constructed that the milk may be let off gently before the cream, which is collected by itself. This saves all the trouble of skimming. Brass pans have the advantage of



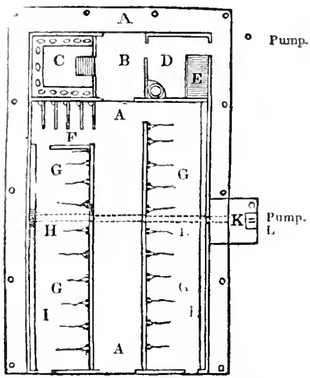
Side View.



Section of a Cow-house.



Section of a Dairy.



Ground Plan.

A, A, A, passage through the cow-house and dairy, ten feet wide, paved with bricks set on edge, or Dutch clinkers. The food is brought in this passage in a small cart and distributed to the cows.

B, part of the above passage closed in with doors, and forming a vestibule to the dairy.

C, dairy-room, in which only milk, cream, and butter are kept. It is sunk three feet under the level of the cow-house, and covered with a brick arch; it has one latticed window, and several ventilators on a level with the place on which the milk vessels are set.

D, the room where the utensils are scalded, and where cheese is made; in one corner is a fire-place, with a large kettle or a copper set.

E, stairs to go up to the cheese-room M and loft N.

F, calf-pens, in which the calves are tied up to fatten, so that they cannot turn to lick themselves; a small trough with pounded chalk and salt is placed in each pen.

G, the place for the cows without partitions; each cow is tied to two posts by two small chains and two iron rings, which run on the posts. The chains are fastened to a broad leather strap, which is buckled round the neck of each cow. H, H, two sinks, with iron gratings over them, to catch the urine from the gutters I, I, which run all the length of the cow-house on each side.

K, the urine tank, vaulted over with a door L, to clean it out, and a pump to pump up the liquid manure. O, O, in the section, are places where the green food or roots are deposited for the day's consumption. P, a hayloft.

being readily warmed on a chafing-dish in winter. In Devonshire, tin or brass pans are frequently used instead of earthen-ware. Although there is some danger in the use of brass utensils, very little attention will obviate it. It only requires that they should be kept bright, in which case the smallest speck of oxide or verdigris would be perceptible. In Holland the milk is invariably carried in brass vessels. Cast-iron pans have been invented, which are tinned inside. They are economical, but there is nothing better or neater than well-glazed white crockery-ware, of the common oval form. Some recommend unglazed pans for summer, but they are difficult to keep sweet, as the milk insinuates itself into the pores, and is apt to become sour there.

The most common use of cows is to supply butter and cheese (see *Butter* and *Cheese*), and sometimes to fatten calves for the butcher; but the most profitable dairy is that which supplies large towns with milk. In these dairies the system is different. The cows are mostly kept in stalls, and fed with food brought to them. Some dairymen possess several hundred cows, and the arrangement of their establishments is worthy of notice. The cows are bought before or after they have calved. They are seldom allowed to go to the bull, but are kept as long as they can be made to give milk by good feeding. When they are dry, they are often already sufficiently fat for sale, or, at all events, they soon fatten, and are sold to the butcher. A succession of cows is thus kept up, new ones arriving as others are sold off. The cows are milked twice a day; and as it is well known that the last drop of milk is the richest, they are sure to be milked quite dry, an essential thing in a dairy. When there is more milk than there is a demand for, it is set, and the cream is sold separately, or made into butter; but this is seldom done to any extent. The cows are fed on every kind of food that can increase the milk: brewers' grains and distillers' wash are preferred, when they can be obtained. The grains are kept in large pits, pressed close, and covered with earth, under which circumstances they will remain fresh a long time. Turnips and beet root are used in large quantities, but hay is given sparingly. The cows are generally placed in pairs, with a partition between every two pair. Each cow is fastened to the corner of the stall, where she has a small trough with water before her: thus they cannot gore each other with their horns. The great dairies are kept very clean; but the liquid manure, which would be so valuable for the market gardens, is lost, and runs off. In Belgium the urine would be contracted for at the rate of ten dollars per cow per annum, which, in a dairy of six hundred cows, would pay a good interest for the money expended in constructing large vaulted cisterns under each cow-house.

There is no chance of profit in a dairy of which the farmer or his wife is not the immediate manager. The attention required to minute particulars can only be expected in those whose profit depends upon it. A proper attention to keeping correct accounts of every expense will convince any one of this truth. In a dairy farm the great difficulty is to feed the cows in winter. It is usually so arranged that the cows shall be dry at the time when food is most scarce, and they are then kept on inferior hay, or straw, if it can be procured. It is a great improvement in a dairy farm if it has as much arable land attached to it as will employ one plough, especially if the soil be light; but the mode of cultivating this farm must vary from that of other farms, since the food raised for the cows must be a principal object. Corn is a secondary object; and the cultivation of roots and grasses must occupy a great portion of the farm. When the grasses degenerate, a crop or two of corn is taken, and the rotation is chiefly roots, corn, and grass cut for hay until it wears out. If the roots are well manured, the land keeps in excellent heart. The old pastures are kept for summer feeding. Where there is no arable land near a dairy farm, it deserves mature consideration whether it will be advantageous or not to allow some of the pasture to be ploughed up. It is often a dangerous experiment where the soil is naturally heavy. Arable land laid down to grass for the purpose of the dairy seldom produces fine-flavoured butter or good cheese; but clover-hay is excellent for young stock, or to fatten off the old cows. Lucern is reckoned to make cows give very good milk; nothing, however, can equal a rich old pasture, as all dairymen agree."

The following estimates from Colman's Report on the Agriculture of Massachusetts give the yield, expenses, and profits of the dairy:

"In Tyringham, the average yield of a cow is reckoned at, new milk cheese 283 pounds, and butter at the same time 57 pounds. A dairy of twenty-eight cows gave 7912 pounds of new milk cheese, and 1600 pounds of butter. A large amount of pork was fattened on this farm, but it is difficult to say what portion of it is to be credited to the dairy.

"In Sheffield, the average product of twenty-eight cows was 394 pounds of new milk cheese, and 50 pounds of butter each.

"The product of a cow is thus stated by the excellent manager:

"Cow, Cr.

400 lbs. new milk cheese, at 8 cts .	$32 00
Calf (killed at 3 days old)	1 00
50 lbs. butter, at 16 cts.	8 33
Whey and butter-milk to make 100 lbs. pork	8 00
	$49 33

Cow, Dr.

Winter keeping	$12 00	
One acre of land, costing $50, will pasture the cow . .	3 50	
Salt 25 cts., 3 bush. of bran, $3	3 25	
Interest on the value of cow, at $25, 10 per ct.	2 50	
Labour of milking, making butter, cheese, &c.	4 00	25 25
Balance in favour of cow . .		$24 08"

DAMSON. A small variety of the *Plum*.

DANDRUFF. Scales of skin, which are brushed off readily.

DAPPLE. Marked with various colours.

DARNEL. Several grasses are so called. The *Cheat* of the United States goes under this name in Europe; but it is principally applied to the *Lolium temulentum*, a troublesome weed.

DARTARS. In farriery, a sort of scab or ulceration taking place on the chin, to which lambs are subject.

DATE. The fruit of a palm (*Phœnix dactylifera*), remarkable for its nutritiousness, and as affording food to entire populations.

DATURA. The generic name of the thorn apple or Jamestown weed, a poisonous plant.

DAUCUS. The generic name of the *Carrot*.

DEAD TOPS. The dead summits or branches of old trees. They should be cut at a sound place, and the wound covered with grafting wax or clay.

DEAFNESS. A defect in hearing. It is sometimes remedied by syringing the tube of the ear with tepid water, by which a quantity of hardened wax is washed out.

DEAL. Pieces of sawed pine or fir wood, three inches thick, nine wide, and twelve feet long.

DEBRIS. In geology, mineral rubbish worn from a rock or formation.

DECAGON (from δεκα, *ten*, and γωνια, *an angle*). Any solid having ten sides and angles.

DECANDRIA (from δεκα, *ten*, and ανηρ, *a male*). The class of plants having ten stamens.

DECANT. To pour off the clear fluid after a precipitate subsides. Hence *Decantation*.

DECAPODS (from δεκα, *ten*, and πους, *a foot*). Crabs with ten feet. Animals like the cuttle-fish, with ten tentacula, wherewith they walk.

DECAY. The destruction of organized bodies by natural causes. The products depend on the presence or deficiency of air. In the first case, the process is called *Eremacausis*; in the second, *Fermentation*, which see.

DECIDUOUS. Parts which fall off, such as hairs, horns, leaves, &c.

DECOCTION. Any mixture which has been boiled.

DECOMPOSITION. In chemistry, the separation of the parts of any compound, whether mineral or organic. Electricity and heat are the principal forces used by chemists for this purpose, and they are capable of disturbing most combinations. Chemical affinity, or the attraction which one form of matter has for another, is also an agent of decomposition. Thus oil of vitriol (*sulphuric acid*) has a powerful attraction for water; if it be dropped on the human hand a blister is instantly produced, and the part blackens. This decomposition is owing to the greater affinity of the acid for water than the flesh of the hand. In the same way some minerals act on each other, producing change of composition, or decomposing them. Decompositions may be expected if one of the ingredients is of a volatile or gaseous nature, or if the agent added forms with one of the original components a product which is insoluble in water. Thus sulphuric and oxalic acid decompose every solution of lime, because they form insoluble salts with lime. Carbonic acid, in its salts, is decomposed by every fixed acid, because it is gaseous. Lime, potash, and soda decompose most salts of ammonia, because the latter is volatile.

DECOMPOSITION OF FORCES. A problem in physics, in which it is desired to know in how many different directions several forces have acted to produce a given result.

DECOMPOSITION OF LIGHT. The separation of a beam of light by means of a prism of glass, into the seven colours, red, orange, yellow, green, blue, indigo, violet, which are hence called the primary colours, light being the result of their mixture.

DECORTICATION (from *de*, *from*, and *cortex*, *bark*). Taking off the bark. Scraping the bark, and even partially removing it during the active growth (June), has been found to invigorate trees. It is often resorted to in bark-bound trees which bear little fruit. Care must be taken not to wound the new wood or expose the sap.

DECOY. "A device by which aquatic birds, chiefly ducks, are enticed from a river or lake up a narrow, winding canal or ditch, which, gradually becoming narrower, at last terminates under a cover of network, of several yards in length. The birds are enticed by the smoothness of the turf on the margin of the canal, which tempts them to leave the water, and begin to dress their plumage. When so engaged at some distance up the canal, they are suddenly surprised by the decoy man and his dogs, who have been concealed behind a fence of reeds; and having again taken to the water, they are driven up by the dogs till they enter within the network which terminates the decoy, and are then easily caught."

DECREPITATION. A chemical term signifying *crackling*, and used to describe the sound made by nitre, salt, sulphate of potash, and other salts, when thrown into the fire.

DECUMBENT. In botany, inclined downward.

DECURRENT. In botany, a leaf, a part of the lamina of which is attached to the stalk of the plant.

DECUSSATE. To cross and intermingle, in anatomy.

DEER. The common species is the *Cervus Virginianus* of naturalists; it is diffused throughout the United States as far north as Canada. The moose (*C. alces*) is the largest species of the deer; it inhabits swamps, and is confined to the most northern parts of the States, and to Canada. The reindeer (*C. tarandus*) is remarkable for its immense horns, its value to the inhabitants of the highest latitudes, docility, and abstemiousness. It is rarely seen in the States except in Maine. Some other species are found far in the northwest.

DEFLAGRATION. A chemical term, meaning very rapid combustion, as when nitre is thrown on red-hot coals.

DEFLECTION. A term in optics. When a thin opaque body is placed in the course of a ray of light, the ray is bent out of its straight direction. The phenomenon is also called diffraction.

DEGLUTITION. The act of swallowing.

DEHISCENT. A botanical term signifying the bursting open, when dry, of seed vessels.

DELIQUESCENT. Saline substances which absorb so much moisture from the air as to become fluid are called deliquescent.

DELPHINIA. A vegetable alkaloid from Stavesacre, or *Delphinium*.

DELPHINIC ACID. An oily acid, obtained from whale oil, having a rancid smell.

DENDROMETER (from *δενδρον, a tree*, and *μετρον, a measure*). An instrument like an immense pair of compasses, to measure the height and the girth of trees, for estimating the amount of timber.

DENTATE (from *dens, a tooth*). Toothed.

DENTIROSTERS. Birds having a tooth-like notch on each side of the upper mandible. They are very rapacious.

DEOBSTRUENT. A medicine given to remove any obstruction in the bowels, &c.

DERBYSHIRE SPAR. Fluor spar, or fluoride of calcium.

DESPUMATION. The act of skimming the scum from any heated fluid.

DESTRUCTIVE DISTILLATION. The heating of bones, wood, coal, &c., in iron vessels, at a high temperature, to produce peculiar substances. From green wood, vinegar and wood tar; from bones, impure ammonia; from coal, gas, coal tar, &c.

DETERGENTS. Medicines which remove impurities and cleanse sores.

DETONATION. In chemistry, explosions on a small scale

DETRITUS. The broken and pounded remains of rocks.

DEUTOXIDE, BINOXIDE. A compound acting as a base, which contains two atoms of oxygen.

DEVON CATTLE. Esteemed for draught. See *Cattle*.

DEW. The deposite of water from the air produced by cold; it becomes frost when the cold is below 32° Fahrenheit. As soon as the sun sets, the heat imparted to the earth begins to fall by radiation into space; if clouds be present, the heat is mostly returned again; if in a clear sky, it is lost, and the earth's surface chilled. The cold of the surface chills the air lying above it, and causes a deposite of its water; hence the dew. Those bodies which cool quickest receive most dew; black soils more than light-coloured; rough surfaces more than polished. Dew, therefore, only falls on clear nights, and frost observes the same rule. When the atmosphere is loaded with water, the cooling of a few degrees is sufficient to form dew; hence most falls near rivers and streams.

DEW POINT. The temperature at which dew falls. It is a very important fact in meteorology, and easily ascertained. Place in a clean wine-glass, half full of water, a little ice, until a mist of dew is seen on the outside; remove the ice without wetting the surface, plunge a thermometer into the water, and observe the temperature as the mist disappears: the degree marks the dew point. This is the simplest way, and as good as any. The difference in degrees between the air and dew point is called the *drying power*, and shows how much more moisture the air will take. When they agree, the air is filled or *saturated* with moisture. The amount of water in the atmosphere is connected with the probability of rain, the growth of plants, the occurrence of mildew, rust, &c., and should be measured by the farmer on important occasions as a means of ascertaining its relation to these points.

DEWBERRY. The creeping *blackberry*, which see.

DEWLAP. The fold of skin below the neck of cattle.

DEXTRINE. Soluble starch, resembling gum, but having the property of turning the plane of polarization to the right ; hence its name. The descending sap and cambium contain much dextrine. It consists of $C_{12}\ H_{11}\ O_{11}$.

DIACHYLON. A common and useful sticking plaster for wounds, made of litharge and resin spread on linen.

DIADELPHIA, DIADELPHOUS (from *δις*, *twice*, and *αδελφις*, *a brotherhood*). A Linnæan class, in which the stamens are bound together into two parcels.

DIAGNOSIS (from *διαγινωσκω*, *to discern*). The determination, by symptoms, of one disease from another.

DIAMETER. The measure across a circle or other regular figure.

DIAMOND. A rare gem, of organic origin, consisting of pure carbon, and crystallized in octohedrons, dodecahedrons, and other derivative forms. The hardest body in nature.

DIANDRIA, DIANDROUS (from *δις*, *twice*, and *ανηρ*, *a man*). Plants with two stamens. See *Botany*,

DIAPHANOUS (from *δια*, and *φαινω*, *to shine*). Translucent : not quite clear like glass.

DIAPHORESIS (from *δια φορεω*, *I carry through*). Sweating, or perspiration ; hence *diaphoretics*, medicines which produce sweating.

DIAPHRAGM (from *δια*, and *φραττω*, *I divide*). Any substance which divides a cavity. Thus, the muscle which lies between the chest and abdomen is a diaphragm ; the matter dividing the cells of shells ; the disks which are inserted into microscopes are also called diaphragms. *Septum* is synonymous. *Diaphragmitis* is an inflammation of the diaphragm in animals.

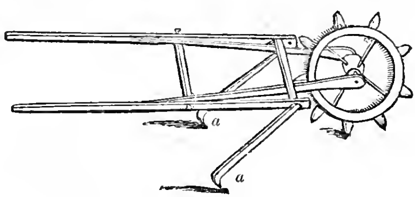
DIARRHŒA (from *διαρρεω*, *I flow through*). Looseness of the bowels. Chalk and binding medicines are remedies. See *Horse*, *Ox*, *Sheep*.

DIASTASE (from *δια*, and *ιστημι*, *I set*). A condition in the decay of fibrin and other protein compounds, which, acting like a ferment, converts solution of starch into sugar. 1 part of changed protein converts 2000 of starch. It occurs in malting and germination. The existence of diastase as a separate body is unknown, its effects being the result of change, and not due to the presence of any specific agent. Its property is destroyed by a boiling heat.

DIATHERMAL (from *δια*, and *θερμη*, *heat*). Bodies which allow radiant heat to pass through them, as rock salt.

DIATHESIS (from *διατιθημυ*, *I dispose*). A predisposition to a particular class of diseases.

DIBBLE. An instrument to make holes in the soil for the insertion of transplanted vegetables, sowing large seeds, onions, &c. It is commonly no more than a rod, with a spade handle, the lower part or point shod with iron, and sharp. A man, carrying one in each hand, walks backward, dibbling a hole right and left, at suitable distances ; 3000 holes can be made thus in a day. The following is a simple and effective contrivance used for beans, potatoes, &c. ; it is so arranged that the side rods, pointed with iron (*a*, *a*), run a mark or drill, into which the dibble afterward runs. Several wheels may be fitted to one axis, and thus a great deal of labour done. It is adapted to light, mellow soils ; and the saving of seeds and la-



bour soon pays for the machine. A number of these wheels drawn by a horse has been recently introduced.

DICHOTOMOUS (from δις, *twice*, and τεμνω, *I cut*). Bifurcate. It is used in natural history to indicate a division into two parts, especially when it is repeated several times, as in some stems.

DICHROISM (from δις, and χρωμα, *colour*). Bodies which exhibit two colours, as they are examined by reflected or refracted light. Dichromatic is a derivative

DICOTYLEDONS (from δις, and κοτυληδων, *a seed lobe*). One of the great divisions of the vegetable kingdom, including most plants and trees of temperate climates. They bear seed with two lobes, like the bean, have leaves freely veined, and the trees grow with a conical trunk. The term is synonymous with *exogens*.

DIDELPHYS (from δις, and δελφυς, *womb*). A genus of animals resembling the opossum and kangaroo, which bring forth minute young, and afterward nourish them in an external pouch. *Marsupials*.

DIDYNAMOUS (from δις, and δυναμις, *power*). Flowers with four stamens, two being longer than the rest. See *Botany*.

DIETETICS (from διαιταειν, *to nourish*). The study of varieties of food. See *Fodder*.

DIFFERENTIAL THERMOMETER. A thermometer with two bulbs, invented to measure differences in temperature, but seldom used.

DIFFRACTION. See *Deflection*.

DIFFUSION OF GASES. Penetration of gases. The expression of a phenomenon which occurs when one gas is set free into another. They mutually expand or diffuse into one another, so as to produce, in time, an equal mixture. The rapidity of diffusion differs with different gases. By reason of this law, noxious vapours rising from the earth are presently diluted into the atmosphere. The composition of the air is the result of the diffusion or admixture of the several gases it contains. This passage takes place through all porous vessels, tissues, &c. In virtue of this property, gases are said to act as a *vacuum* towards each other.

DIFFUSUS. Spreading: used in botany.

DIGESTER. A strong iron or copper pot, the lid of which fits steam-tight, and either screws on or is pressed by clamps, and is furnished with a safety-valve. It is used for boiling or digesting substances at a heat greater than boiling water, and is especially useful for extracting jelly and glue from bones, skins, horns, &c.

DIGESTION. In physiology, the change through which food passes in the stomach for the production of *chyme*. Food received into the stomach is speedily attacked by a peculiar fluid therein, the *gastric*, which has the power of rendering soluble the insoluble parts: this it effects by producing a change nearly resembling fermentation. The gastric juice is a portion of the membrane of the stomach in a peculiar state of change, resembling diastase, and supposed to owe its power to a principle called *pepsin*, but being in reality active only because in a state of change. The food acted on by this agency is converted into a pasty mass called *chyme*; this, passing into the bowels, is separated into a fluid part, *chyle*, which is absorbed by the veins and absorbents of the intestines, and reaches the blood to add to that fluid. There is reason to believe that starchy and saccharine bodies are converted into lactic acid, and in part into oils, by digestion. The remaining thickened chyme, receiving several excretions, becomes mere feculent matter. The process of digestion requires from one to four hours, according to the food. Raw substances are digested more rapidly than boiled, fresh than salt. It is best conducted when the body and mind are in a state of rest.

DIGESTION IN CHEMISTRY. The exposure for a long time of any substance to the action of water or a solvent at a gentle heat.

DIGGING. See *Spade*.

DIGITALIS. The generic name

of the foxglove (*D. purpurea*), a poisonous sedative.

DIGITATE. In botany, any leaf divided into several segments originating in a common centre.

DIGYNIA (from δις, and γυνη, *a woman*). Flowers with two styles. See *Botany*.

DILL. *Anethum graveolens*. An umbelliferous plant, the seeds of which are esteemed as a medicine. They contain dill oil, which, being distilled, is used in solution in water for the gripes of infants. It is an annual, requiring a dry, rich soil. Sow in drills in March or April, keep clear of weeds, thin out to ten inches; they fruit in September. Fresh seed must be used for planting. The leaves are sometimes used like parsley.

DILUENTS. Any fluid, as water, which dilutes.

DILUVIUM, DILUVION. Accumulations of gravel found upon the ordinary rocks in many places.

DINGLE. A small valley.

DIŒCIA, DIOICA (from δις, *twice*, and οικια, *house*). Flowers, the stamens and pistils of which are on distinct plants, as the hop, hemp, &c.

DIOPTRICS (from δια, and οπτομαι, *I see*). That part of optics which investigates the passage of light through glasses, &c.

DIOSCOREA. The generic name of the yam See *Sweet Potato*.

DIPLOE (Greek). The cellular layer between the outer and inner layers of the scull bones.

DIPPLE'S ANIMAL OIL. A fetid oil obtained by the distillation of bones, used as an antispasmodic.

DIPSACUS. The generic name of the teasel.

DIPTERA, DIPTERANS (from δις, *twice*, and πτερον, *a wing*). Flies or insects with two wings only. They are furnished with a sucker.

DISCUTIENT (from *discutio, I destroy*). Any application which has the property of resolving or hindering the formation of tumours or boils.

DISEASES. See *them*, or *Ox*, *Horse*, *Sheep*.

DISK. Any flat, round body: hence *discoid*. In botany, any space existing between the insertion of the stamens and the ovary.

DISPERSION OF LIGHT. Its separation into the colours by a prism.

DISSEPIMENTS. The dividing membranes formed in ovaria by the union of the sides of two carpels.

DISTEMPER. Frequently used in the same sense as disease, but is particularly applied to cattle. In racing stables it is the distinguishing name for epidemic catarrh or influenza in horses. Bleeding in the early stage is recommended, and it is important that the bowels should be evacuated and sedative medicines given. (See *Horse*). In dogs, distemper is one of the most fatal diseases; a little emetic powder (three grains of tartar emetic and one grain of opium) is recommended to be given.—(*Clater's Far.*, p. 392).

DISTICHOUS (from δις, and στικος, *a row*). Two rows of seeds, leaves, &c., arranged side by side. A term of frequent use in descriptive botany.

DISTILLATION. A chemical process, whereby the more volatile parts of a mixture are separated by heat. It is conducted in a still of metal, usually copper, except where a great heat is necessary, as in destructive distillation, when iron is used. Earthen-ware and glass are used for many chemical distillations. Vessels of this kind are called retorts or alembics. A retort is of the figure of a large inverted comma; if there be an aperture over the bulb fitted by a stopper, or to receive a tube, it is termed a tubulated retort. (See *Retort*.) An alembic consists of two parts, an upper cap, which carries the tube, or beak, along which the distilled fluid passes, and a lower vessel to contain the matter for distillation. The cap is well luted or fastened before use.

The heat employed is regulated to the purposes of the operator. If the object be to separate alcohol from water, the heat must not rise above the boiling of alcohol (176°). As the vapour rises, it is at first cooled along the tube, or beak, of the retort, and flows down it into the *receiver*; but the tube becoming heated, steps must be taken to produce the condensation. This is managed in the laboratory by keeping pieces of wet rag on the tube, or by passing it through another larger tube of metal which is cooled by a stream of water. In larger operations, the still beak enters another long tube, which winds several times in a bucket of water, and is thus kept cool, the water being occasionally renewed.

Distillation is employed to separate alcohol, ether, vinegar, and other products from mixtures; to obtain the essential oil of plants; and when much heat is used, to separate gas from coal; tar and vinegar from green wood; hartshorn from bones, whalebone shavings, &c. When a distilled product is re-distilled, it is said to be *rectified*.

DITCH. A trench cut in the ground, usually round the fences of a field. Trenches of this kind are formed differently in various localities, but they should always be made so as to keep the water in them as pure as possible.

DIURESIS (from *δια*, and *ουρεω*, *to make water*). Excessive urination: hence *Diuretics*, medicines causing urination, as nitre, juniper berries, turpentine, cubebs, &c. See *Ball*.

DIVARICATE. To spread out widely.

DIVERGENT. Branches separated by an angle.

DIVISIBILITY. In chemistry, the extent to which pieces of matter may be divided is extraordinary; thus, in gilding, the thickness of gold on a surface is often as little as 110,000th part of an inch. But matter is not infinitely divisible.

DOCK. Troublesome, long-rooted, perennial plants, of the genera *Rumex*, *Tussilago*, &c. See *Weeds*.

DODDER. A weed consisting of thread-like stems, which bind together the plants among which it grows. It is occasionally destructive to small crops, such as flax.

DODECAHEDRON (from *δωδεκα*, *twelve*, and *ἑδρα*, *a seat*). A solid of twelve sides. In crystallography there are two varieties: the rhombic and angular dodecahedron, according to the figure of the sides.

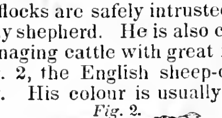
DODECANDRIA (from *δωδεκα*, *twelve*, and *ανηρ*, *male*). The class of plants containing twelve stamens. See *Botany*.

DOE. The female of the fallow deer.

DOG. A genus of animals (*Canis*), including innumerable varieties. The farmer requires a good rat and vermin dog, of which the varieties of terrier are the best; a house-dog, as the Newfoundland, bull-dog, or mastiff; and herd-dogs, as the sheep-dog, the Scotch sheep-dog, or the Spanish shepherd's dog. The last is said to be the most manageable and trusty, as it is the strongest, being nearly as large as a Newfoundland; but the instinct of the Scotch animal cannot be readily surpassed. Hunting and coursing dogs are merely useful for pleasure, but of these the pointer is an animal of rare instinct, and can be taught to equal the best sheep-dogs in caring for flocks.

Fig. 1 is the Scotch shepherd's dog, or colly. Characters: ears partly

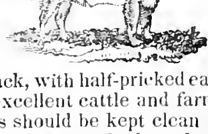
Fig. 1.



erect, head rather pointed, shaggy coat, and thick tail. To this animal large flocks are safely intrusted without any shepherd. He is also capable of managing cattle with great nicety.

Fig. 2, the English sheep-dog, is larger. His colour is usually white

Fig. 2.



and black, with half-pricked ears. He is an excellent cattle and farm dog.

Dogs should be kept clean and fed with wholesome food, under which circumstances they are very healthy. Worming is an absurd and useless custom. The *mange* in dogs is the result of uncleanliness, and resembles itch. It should be treated with tar ointment mixed with sulphur.

Madness.—Symptoms: at first the dog loses spirits, neglects his food, retires from his master, does not bark, but murmurs, is irritable, his ears and tail droop, he seems drowsy, in two or three days his tongue lolls out, he froths at the mouth, the eyes are heavy, he runs along panting, and in two or three more days dies. Any animal bitten should instantly have the part cut out, the wound being allowed to bleed for a short time.

Distemper is very contagious, usually commences with a cold, is followed by fits or diarrhœa, great loss of strength, and frequently death. Treatment: first give emetics, and then a large spoonful of salt dissolved in water; if looseness comes on, give chalk in powder mixed with water. A blister on the head is used when the animal is very stupid and liable to fits. The food should be good.

Other diseases are treated like those incident to sheep.

DOG'S-TAIL GRASS. *Cynosurus cristatus.* See *Grasses.*

DOG'S-TOOTH GRASS. Doub grass. See *Bermuda Grass.*

DOGWOOD. *Cornus Florida.* A small tree, remarkable for its flower-like involucrum. It is found from Massachusetts to Florida, usually on the borders of woods. The bark is medicinal and used as a febrifuge. The heart wood, of a deep brown colour, is hard, heavy, and compact. Its chief use is for the cogs of wheels, points of harrows, and similar purposes: the size is not sufficiently large for other objects.

DOLERITE. A trap rock, consisting of augite and feldspar.

DOLOMITE. Magnesian marble, or granular limestone containing magnesia.

DOLPHIN, BLACK. The *Aphis* of beans, cabbages, &c. See *Black Dolphin.*

DOOB, or DOUB GRASS. *Cynodon dactylon.* A perennial, creeping grass of great value, acclimated in the Southern States, and of celebrity among the Hindoos. It flowers in August, but does not always perfect seed. It is propagated from roots. This is also called Bermuda or Brahma grass. See *Bermuda Grass.*

DORSAL. Belonging to the back.

DOVE. See *Pigeon.*

DOVE-COTE. See *Pigeon-house.*

DOWNS. Elevated, open meadows.

DRAGON FLY. The common name for *Libellulas*, *Agrions*, and other neuropterous insects. They are devourers of insects, and therefore friends of the farmer.

DRAGON'S BLOOD. A blood-red resin imported from India, and used to colour varnishes.

DRAINAGE. "As a certain quantity of moisture is essential to vegetation, so an excess of it is highly detrimental. In the removal of this excess consists the art of draining.

"Water may render land unproductive by covering it entirely or partially, forming lakes or bogs; or there may be an excess of moisture diffused through the soil and stagnating in it, by which the fibres of the roots of all plants which are not aquatic are injured, if not destroyed.

"From these different causes of infertility arise three different branches of the art of draining, which require to be separately noticed.

"1. To drain land which is flooded, or rendered marshy by water coming over it from a higher level, and having no adequate outlet below.

"2. To drain land where springs rise to the surface, and where there are no natural channels for the water to run off.

"3. To drain land which is wet from its impervious nature, and where the evaporation is not sufficient to carry off all the water supplied by snow and rain.

"The first branch includes all those extensive operations where large tracts of land are reclaimed by means of embankments, canals, sluices, and mills to raise the water; or where deep cuts or tunnels are made through hills which formed a natural dam or barrier to the water. Such works are generally undertaken by associations, few individuals being possessed of sufficient capital, or having the power to oblige all whose interests are affected by the draining of the land to give their consent and afford assistance.

"All these operations require the science and experience of civil engineers, and cannot be undertaken without great means. The greater part of the lowlands in the Netherlands, especially in the province of Holland, have been reclaimed from the sea, or the rivers which flowed over them, by embanking and draining, and are only kept from floods by a constant attention to the works originally erected.

"Where the land is below the level of the sea at high water, and without the smallest eminence, it requires a constant removal of the water which percolates through the banks or accumulates by rains; and this can only be effected by sluices and mills. The water is collected in numerous ditches and canals, and led to the points where it can most conveniently be discharged over the banks. The mills commonly erected for this purpose are small wind-mills, which turn a kind of perpetual screw made of wood several feet in diameter, on a solid axle. This screw fits a semicircular trough, which lies inclined at an angle of about 30° with the horizon. The lower part dips into the water below, and by its revolution discharges the water into a reservoir above. All the friction of pumps, and the consequent wearing out of the machinery, is thus avoided. If the mills are properly constructed they require little attendance, and work night and day whenever the wind blows.

"In hilly countries it sometimes happens that water, which runs down the slopes of the hills, collects in the bottoms where there is no outlet, and where the soil is impervious. In that case it may sometimes be laid dry by cutting a sufficient channel all round, to intercept the waters as they flow down, and to carry them over or through the lowest part of the surrounding barrier. If there are no very abundant springs in the bottom, a few ditches and ponds will suffice to dry the soil by evaporation from their surface. We shall see that this principle may be applied with great advantage in many cases where the water could not be drained out of considerable hollows if it were allowed to run into them.

"When there are different levels at which the water is pent up, the draining should always be begun at the highest, because it may happen that when this is laid dry the lower may not have a great excess of water. At all events, if the water is to be raised by mechanical power, there is a saving in raising it from the highest level, instead of letting it run down to the lower, from which it has to be raised so much higher.

"In draining a great extent of land, it is often necessary to widen and deepen rivers, and alter their course; and not unfrequently the water cannot be let off without being carried, by means of tunnels, under the bed of some river, the level of which is above that of the land. In more confined operations, cast-iron pipes are often a cheap and easy means of effecting this. They may be bent in a curve, so as not to impede the course of the river or the navigation of a canal.

"*The draining of land which is rendered wet by springs* arising from under the soil is a branch of more general application. The principles on which the operations are carried on apply as well to a small field as to the greatest extent of land. The object is to find the readiest channels by which the superfluous water may be carried off; and for this purpose an accurate knowledge of the strata through which the springs rise is indispensable. It would be useless labour merely to let the water run into drains after it had sprung through the soil and appears at the surface, as ignorant men frequently attempt to do, and thus carry it off after it has already soaked the soil. But the origin of the springs must, if possible, be detected; and one single drain or ditch, judiciously disposed, may lay a great extent of land dry if it cuts off the springs before they run into the soil. Abundant springs which flow continually generally proceed from the outbreaking of some porous stratum in which the waters were confined, or through natural crevices in rocks or impervious earth. A knowledge of the geology of the country will greatly assist in tracing this, and the springs may be cut off with greater certainty. But it is not these main springs which give the greatest trouble to an experienced drainer; it is the various land-springs, which are sometimes branches of the former, and often original and independent springs arising from sudden variations in the nature of the soil and subsoil. The annexed diagram, representing a section of an uneven surface of land, will explain the nature of the strata which produce springs.

"Suppose A A a porous gravel through which the water filtrates readily; B B a stratum of loam or

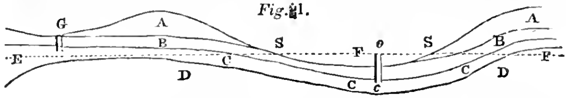


Fig. 1.

clay impervious to water. The water which comes through A A will run along the surface of B B towards S S, where it will spring to the surface and form a lake or bog between S and S. Suppose another gravelly or pervious stratum under the last, as C, C, C, bending as here represented, and filled with water running into it from a higher level; it is evident that this stratum will be saturated with water up to the dotted line E, F, F, which is the level of the point in the lower rock, or impervious stratum, D, D, where the water can run over it. If the stratum B B has any crevices in it below the dotted line, the water will rise through these to the surface, and form springs rising from the bottom of the lake or bog; and if B B were bored through and a pipe inserted rising up to the dotted line, as *c*, *o*, the water would rise and stand at *o*. If there were no springs at S S, the space below the dotted line might still be filled with water rising from stratum C, C, C. But if the boring took place at G, the water would not rise, but, on the contrary, if there were any on the surface, it would be carried down to the porous stratum C, C, C, and run off. Thus in one situation boring will bring water, and in another it will take it off. This principle being well understood will greatly facilitate all drainings of springs. Wherever water springs, there must be a pervious and an impervious stratum to cause it, and the water either runs over the impervious surface or rises through the crevices in it. When the line of the springs is found, as at S S, the obvious remedy is to cut a channel with a sufficient declivity to take off the water in a direction across this line, and sunk through the porous soil at the surface into the lower impervious earth. The place for this channel is where the porous soil is the shallowest above the breaking out, so as to require the least depth of drain, but the solid stratum must be reached, or the draining will be imperfect. It is by attending to all these circumstances that Elkington acquired his celebrity in draining, and that he has been considered as the father of the system. It is, however, of much earlier invention, and is too obvious not to have struck any one who seriously considered the subject. In the practical application of the principle, great ingenuity and skill may be displayed, and the desired effect may be produced more or less completely, and at a greater or less expense. The advice of a scientific and practical drainer is always well worth the cost at which it may be obtained.

"When there is a great variation in the soil, and it is difficult to find any main line of springs, it is best to proceed experimentally by making pits a few feet deep, or by boring in various parts where water appears, observing the level at which the water stands in these pits or bores, as well as the nature of the soil taken out. Thus it will generally be easy to ascertain whence the water arises, and how it may be let off. When there is a mound of light soil over a more impervious stratum, the springs will break out all round the edge of the mound; a drain laid round the base will take off all the water which arises from this cause, and the lower part of the land will be effectually laid dry. So, likewise, where there is a hollow or depression of which the bottom is clay, with sand in the upper part, a drain laid along the edge of the hollow, and carried round it, will prevent the water running down into it and forming a marsh at the bottom.

"When the drains cannot be carried to a sufficient depth to take the water out of the porous stratum saturated with it, it is often useful to bore numerous holes with a proper auger in the bottom of the drain through the stiffer soil, and, according to the principle explained in the diagram, the water will either rise through these bores into the drains and be carried off, and the natural springs will be dried up, or it will sink down through them as at G, in the section, if it lies above. This method is often advantageous in the draining of peat bogs, which generally lie on clay or stiff loam, with a layer of gravel between the loam and the peat, the whole lying in a basin or hollow, and often on a declivity. The peat, though it retains water, is not pervious, and drains may be cut into it which will hold water. When the drains are four or five feet deep and the peat is much deeper, holes are bored down to the clay below, and the water is pressed up through these holes, by the weight of the whole body of peat, into the drains, by which it is carried off. The cuts, *Figs.* 2 and 3, represent a common case of this kind; *h*, *h* (3) are the sides of a hill; the swampy lot below is filled with springs, which are, however, drained by running a

Fig. 2.

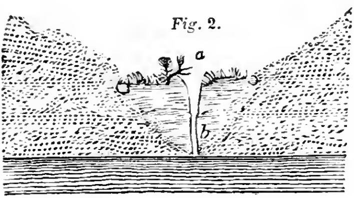
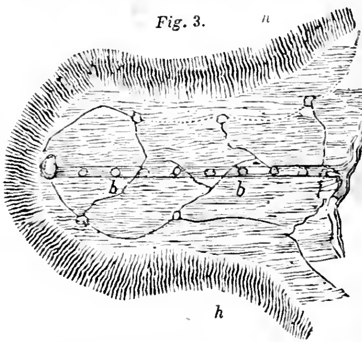


Fig. 3.



ditch (*b*, *b*) across it and sinking holes into the subsoil. One of these holes is shown in *Fig.* 2 (*a*, *b*), and the manner in which it conveys the surface water away. The bottom of the drains is sometimes choked with loose sand, which flows up with the water, and they require to be cleared repeatedly; but this soon ceases after the first rush is past, and the water rises slowly and regularly. The surface of the peat being dried, dressed with lime, and consolidated with earth and gravel, soon becomes productive. If the soil, whatever be its nature, can be drained to a certain depth, it is of no consequence what water may be lodged below it. It is only when it rises so as to stagnate about the roots of plants that it is hurtful. Land may be drained so much as to be deteriorated, as experience has shown.

"When a single large and deep drain will produce the desired effect, it is much better than when there are several smaller, as large drains are more easily kept open, and last longer than smaller; but this is only the case in tapping main springs, for if the water is diffused through the surrounding soil, numerous small drains are more effective: but as soon as there is a sufficient body of water collected, the smaller drains should run into larger, and these into main drains, which should all, as far as is practicable, unite into one principal outlet, by which means there will be less chance of their being choked up. When the water springs into a drain from below, it is best to fill up that part of the drain which lies above the stones or other materials which form the channel, with solid earth well pressed in, and made impervious to within a few inches of the bottom of the furrows in ploughed land, or the sod in pastures; because the water running along the surface is apt to carry loose earth with it, and choke the drains. When the water comes in by the sides of the drains, loose stones or gravel, or any porous material, should be laid in them to the line where the water comes in, and a little above it, over which the earth may be rammed in tight, so as to allow the horses to walk over the drain without sinking in.

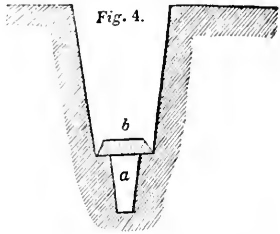
"It sometimes happens that the water collected from springs, which caused marshes and bogs below, by being carried in new channels, may be usefully employed in irrigating the land which it rendered barren before; not only removing the cause of barrenness, but adding positive fertility. In this case the lower ground must have numerous drains in it, in order that the water let on to irrigate it may not stagnate upon it, but run off after it has answered its purpose.

"*The third branch in the art of draining is the removal of water from impervious soils* which lie flat, or in hollows, where the water from rain, snow, or dews, which cannot sink into the soil on account of its impervious nature, and which cannot be carried off by evaporation, runs along the surface and stagnates in every depression. This is by far the most expensive operation, in consequence of the number of drains required to lay the surface dry. It requires much skill and practice to lay out the drains so as to produce the greatest effect at the least expense. There is often a layer of light earth immediately over a substratum of clay, and after continued rains this soil becomes filled with water, like a sponge, and no healthy vegetation can take place. In this case numerous drains must be made in the subsoil, and over the draining tiles or bushes, which may be laid at the bottom of the drains, loose gravel or broken stones must be laid to within a foot of the surface, so that the plough shall not reach them. The water will gradually sink into these drains and be carried off, and the loose wet soil will become firm and dry. In no case is the advantage of draining more immediately apparent. The average depth is 30 inches.

"It is very seldom that a field is absolutely level; the first thing, therefore, to be ascertained is the greatest inclination and its direction. For this purpose, there is an instrument essential to a drainer, with which an accurately horizontal line can be ascertained, by means of a plummet, a bricklayer's level, or a spirit level. A sufficient fall may thus be found or artificially made in the drains to carry off the water. The next object is to arrange drains so that each shall collect as much of the water in the soil as possible. Large drains, except as main drains, are inadmissible. The depth should be such only that the plough may not reach it, if the land is arable, or the feet of cattle tread it in, if it be in pasture. All the drains which are to collect the water should lie as nearly at right angles to the inclination of the surface as is consistent with a sufficient fall in the drains to make them run. One foot is sufficient fall for a drain 300 feet in length, provided the drains be not more than twenty feet apart. The main drains, by being laid obliquely across the fall of the ground, will help to take off a part of the surface water. It is evident that the drains can seldom be in a straight line unless the ground be perfectly even. They should, however, never have sudden turns, but be bent gradually where the direction is changed. The flatter the surface and the stiffer the soil, the greater number of drains will be required. It is a common practice with drainers to run a main drain directly down the slope, however rapid, and to carry smaller drains into this alternately on the right and left, which they call herring-bone fashion. But this can only be approved of where the ground is nearly level, and where there is very little fall for the main drain. A considerable fall is to be avoided as much as possible; and every drain should lie obliquely to the natural run of the water. It generally happens that, besides surface water, there are also some land-springs arising from a variation in the soil; these should be carefully ascertained, and the drains should be so laid as to cut them off.

"In draining clay land, where there is only a layer of a few inches of looser soil over a solid clay, which the plough never stirs, the drains need not be deeper than two feet in the solid clay, nor wider than they can be made without the sides falling in. The common draining tile, which is a flat tile bent in the form of half a cylinder, and which can be made at a very cheap rate, is the best for extensive surface draining. In solid clay it requires no flat tile under it; it is merely an arch to carry the loose stones or earth with which the drain is filled up. Loose round stones or pebbles are the best where they can be procured; and in default of them, bushes, heath, or straw may be laid. In grass land the sod may be laid over the drain, after it has been filled up, so as to form a slight ridge over it. This will soon sink to a level with the surface. To save the expense of stone or tiles, drains are frequently made six inches wide at the bottom; a narrow channel is cut in the solid clay, two or three inches wide and six deep (*a*), leaving a shoulder on each side to support a sod, which is cut so as to fit the drain, and rest on the shoulders (*b*); this sod keeps the earth from filling the channel (see *Fig.* 4). It is filled up as de-

Fig. 4.



scribed before: such drains are made at a small expense, and will last for many years.

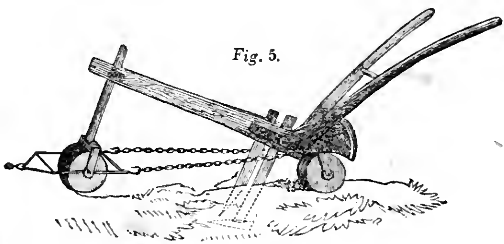
"Where the clay is not sufficiently tenacious, the bottom of the drain is sometimes cut with a sharp angle, and a twisted rope of straw is thrust into it. This keeps the earth from falling in, and the running of the water keeps the channel open; the straw, not being exposed to the air, remains a long time without decaying. It is a common mistake to suppose that in these drains water enters from above; it rises from below.

"The best materials for large main drains, where they can be procured, are flat stones which readily split, and of which a square or triangular channel is formed in the bottom of the drain. If the drain is made merely as a trunk to carry off the water, it is best to fill it up with earth, well pressed in, over the channel made by the stones. A very useful draining tile is used in Berkshire and other places, which requires no flat tile under it, even in loose soils, because it has a flat foot to rest on, formed of the two thick edges of the tile, which, nearly meeting when the tile is bent round, form the foot. The section of the tile is like a horseshoe. It is well adapted for drains where the water springs upward, and it is less apt to slip out of its place than the common tile.

"In draining fields it is usual to make the outlets of the drains in the ditch which bounds them. The fewer outlets there are, the less chance there is of their being choked: they should fall into the ditch at two feet from the bottom, and a wooden trunk, or one of stone, should be laid so that the water may be discharged without carrying the soil from the side of the ditch. If there is water in the ditch, it should be kept below the mouth of the drain. The outlets of all drains should be repeatedly examined, to keep them clear; for wherever water remains in a drain it will soon derange or choke it. The drains should be so arranged or turned that the outlet shall meet the ditch at an obtuse angle towards the lower part where the water runs to. A drain brought at right angles into a ditch must necessarily soon be choked by the deposition of sand and earth at its mouth. The channel or waterway of drains is liable to the inroads of rats, moles, and other vermin; they may be kept out by inserting occasionally a piece of perforated tin plate, or wire grates.

"As the draining of wet clay soils is the only means by which they can be rendered profitable as arable land, and the expense is great, various instruments and ploughs have been contrived to diminish manual labour and expedite the work. Of these one of the simplest is the common mole plough (*Fig.* 5), which, in very stiff clay, makes a small hollow drain, from

Fig. 5.



Lumbert's Mole Plough.

one foot to 18 inches below the surface, by forcing a pointed iron cylinder horizontally through the ground. It makes a cut through the clay, and leaves a cylindrical channel, through which the water which enters by the slit is carried off. It requires great power to draw it, and can only be used when the clay is moist. In meadows it is extremely useful, and there it need not go more than a foot under the sod. Five to ten acres of grass land may easily be drained by it in a day. It is very apt, however, to be filled in dry weather by the soil falling in; and moles often do much damage to it by using it in their subterraneous workings.

"But draining ploughs have been invented which greatly accelerate the operation of forming drains, by cutting them out in a regular manner, when they are immediately finished with the usual tools and filled up. See *Draining Plough.* It has done wonders in some of the wet, stiff soils in Sussex, and is much to be recommended in all wet and heavy clays. In stony land it cannot well be used. The subsoil plough, introduced to public notice by Mr. Smith, of Deanston, may be considered, in some measure, as a draining plough, for it loosens the subsoil, so that a few main drains are sufficient to carry off all the superfluous moisture; and it has, besides, the effect of not carrying off more than what is superfluous. By means of judicious drains and the use of the subsoil plough the stiffest and wettest land may in time become the most fertile.

"The tools used in draining are few and simple. Spades, with tapering blades of different sizes, are required to dig the drains of the proper width and the sides at a proper angle. When the drain begins to be very narrow near the bottom, scoops are used of different sizes, which are fixed to handles at various angles, more conveniently to clear the bottom and lay it smooth to the exact width of the tiles, if these are used; for the more firmly the tiles are kept in their places by the solid sides of the drain, the less likely they are to be moved.

Figs. 6, 7, 8, represent three of the most common tools. A heavy plough is first run in the line of the drain and back, unless it be desirable to retain the sod, which must be cut off with a spade. In the furrow so made a hand enters with the spade *a*, which is six inches wide at the top, four below, and fourteen inches deep; the spits of earth are thrown to the right, the turf being on the left side. Another workman follows with *b*, which is four inches above and two or three below, according to the intended size of the channel of the drain. Lastly, the scoop, *c*, is used to take out the last portions of earth, and clear away any rubbish.

Fig. 6.

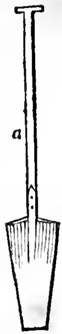
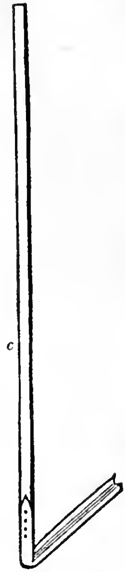


Fig. 7.

Fig. 8.



DRAINING PLOUGH. Several massive ploughs have been constructed for the purpose of opening the greater part of the ditch at one stroke: they are double mould-board ploughs. *Figs.* 1 and 2 represent two views of Gray's draining plough. In 1 the

Fig. 1.

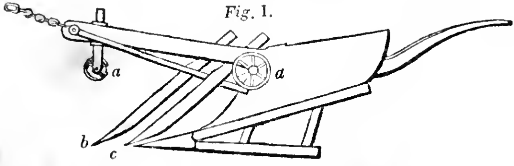
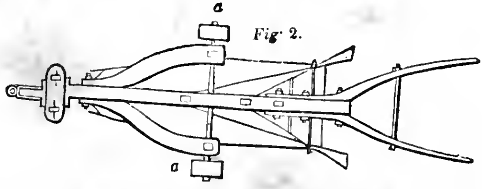


Fig. 2.



side is figured, and 2 is taken from above. *a a* are wheels which, with the front wheel, regulate the depth of the furrow. A stout coulter, *b*, is fixed before the share to cut the way. Perpendicularly on each side two coulters, *c*, are fixed, which cut in an inclined direction to form the sides of the drain: they can be set for any required inclination. The earth thus cut is divided by the share, half being forced up each side of the mould-board as the plough advances. It requires six to eight strong horses to draw it.

DRASTIC (from *δραστικος, active*). Medicines which act violently.

DRENCH. In farriery, a large drink or draught of any liquid remedy given to an animal, usually by means of a horn properly cut for the purpose.

A drink is not so portable as a ball; it is more troublesome to give, and a portion of it is usually wasted. Mr. Stewart strenuously urges the following propositions: 1. That draughts, particularly when pungent or disagreeable, are dangerous. 2. That by no care can the danger be altogether avoided. 3. That no draught should be given unless the horse be in danger of dying without it. 4. That the safest way of administering draughts is to give them when the horse is lying. 5. That a draught is seldom or never absolutely necessary but in diseases that make the horse lie. 6. That a bottle is a better drenching instrument than a horn.

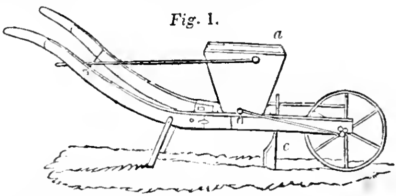
DRESSING. In farriery, the application of plasters, &c., to wounds. The application of manure.

DRILL. A long, straight line, in which seeds or plants are set. *Drill husbandry* is the cultivation of crops in drills instead of broad-cast.

DRILL MACHINES. Contrivances for the purpose of running a drill furrow, depositing seed therein, and covering it with earth. They are simple—making one furrow only, for beans, pease, &c.—or compound, making many drills, for wheat, turnips, &c. The principal difficulty in the action of drills is the inequality of the soil. Sometimes a contrivance for the deposite of manures is added to the machine, which becomes a seed and manure drill. Adjustments for the width of furrows are also introduced in the more complex implements

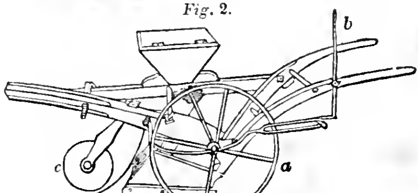
Fig. 1 represents the simplest drill

Fig. 1.



barrow. *a* is the hopper containing seed; the bottom is closed by a cylinder, in which there are holes at proper distances for one or more seeds; this is made to revolve by a string or strap of leather passing from the axis of the wheel to the axis of the cylinder; *c* is a coulter which scrapes the furrow, and behind it the seeds are deposited as the cylinder turns round. Such a machine has to be used upon land already pre-

Fig. 2.



pared, and is run along the summit of the furrows.

Fig. 2 is a much more important single drill for beans, &c. It is furnished with a circular coulter, *c*; a small double-mould-board plough; a wheel, *a*, to regulate the depth of furrow; and an arrangement of levers, *b*, by which the seed-cylinder is thrown out of gearing in a moment by the workman, as the barrow is moving over the butts, &c. The revolving cylinder, in this case, is moved by an axis furnished with a cog-wheel, set in motion by the wheel itself. It is a very excellent machine, and can be used to prepare the soil, or on level ground, without previous ploughing.

Figs. 3 and 4 represent views of a turnip drill barrow, with a contrivance for fluid manure, water, &c., to be deposited at the time of sowing. The seeds are contained in a cylindrical tin can, furnished with holes at proper distances, *b*; this is set in motion by the band running from the wheel, and deposites the seed in a funnel, the front part of which scrapes the drill; *a* is the reservoir of fluid, which discharges its contents along the tube, *d*, immedi-

Fig. 3.

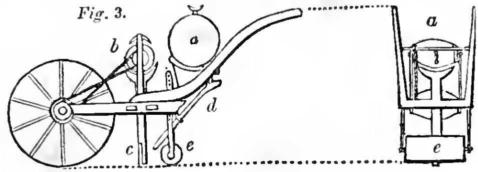


Fig. 4.

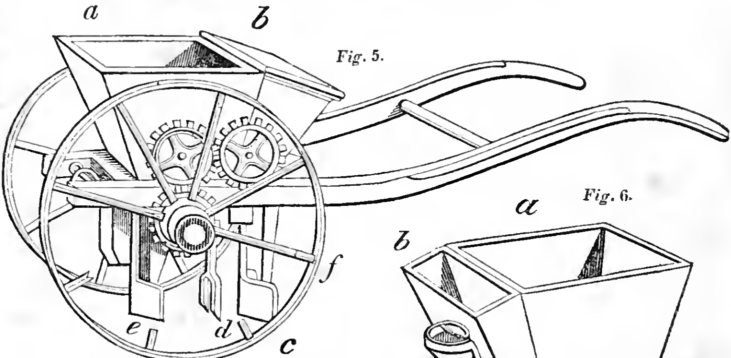
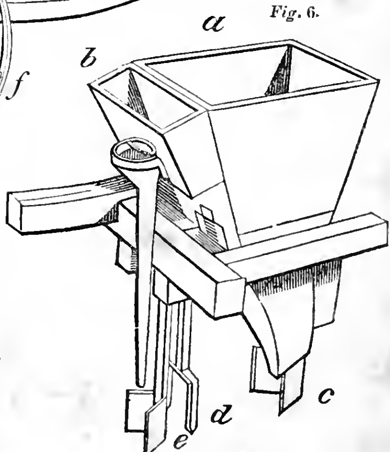


Fig. 5.

Fig. 6.



ately upon the seed sown; after the stream, the roller, *e*, serves to cover the seed, and thus completes the operation. *Figure* 4 represents the seed cylinder, funnel, and roller from behind. The stream of fluid manure is necessarily very fine.

Weir's manuring one-row drill is figured in 5 and 6. It is a great improvement on the celebrated Northumberland turnip drill.

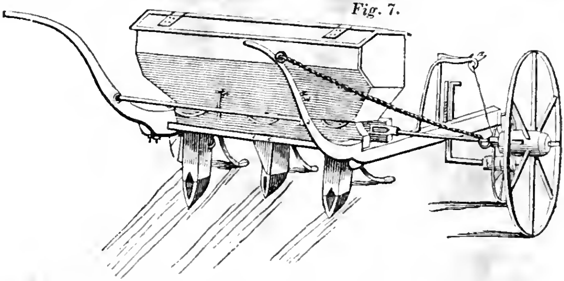
"It has a manure hopper, *a*, and a seed hopper, *b*, the same as the other; but the manure, in place of being dropped along with the seed, is deposited in a deep gutter made by a coulter, *c*, which goes before; this manure is covered by a pronged coulter, *d*, which follows the other; next comes the coulter which forms the gutter for the seed, *e*. The seed is thus deposited about one inch above the manure. One roller of the concave kind goes before the machine, and another light one of the common kind follows after it; or, without attached rollers, the drill may be affixed to one side of the common roller, behind, which roller may prepare one drill and cover the seed sown on another each course."

The deposite of seed in this and the best drills is managed by a revolving axis, turned by a cog-wheel, which fits into a wheel on the axis of the large wheel, *f*.

Morton's grain drill, for three or five furrows, is shown in *Fig*. 7. The following is Loudon's account of this machine:

"It is decidedly the simplest and

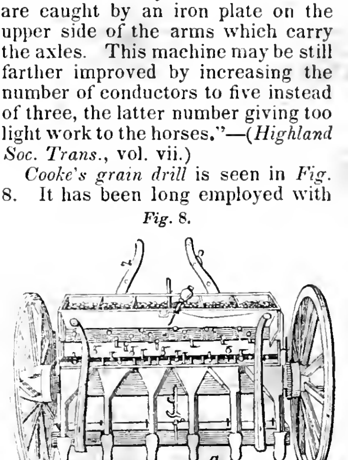
Fig. 7.



best of grain drills. In this machine three hoppers are included in one box, the seed escaping out of all the three by the revolution of three seed cylinders upon one axle; and drills of different breadths are produced simply by the shifting of a nut, that fixes a screw moving in a groove in the under-frame, by which the distance between the two outside conductors and the central one (which is fixed) can be varied from nine to ten or eleven inches; and that the two small wheels may always be at the same distances respectively as the conductors, there are two washers (hollow cylinders), an inch in breadth, on the axle-arms of each, which may be transferred either to the outside or inside of the wheels, so as to make their distances from the outside conductors nine, ten, or eleven inches respectively also. The small wheels may be raised or depressed, so as to alter the depth at which the seed shall be deposited, by the action of a wedge, which retains the upright part of the axle in any one of a number of notches, which are made similarly in both, and which are caught by an iron plate on the upper side of the arms which carry the axles. This machine may be still farther improved by increasing the number of conductors to five instead of three, the latter number giving too light work to the horses."—(*Highland Soc. Trans.*, vol. vii.)

Cooke's grain drill is seen in *Fig*. 8. It has been long employed with

Fig. 8.



success in the light soils of Norfolk and Suffolk, England. On the beam, *a*, the coulters to prepare drills are arranged, the whole being capable of lateral motion, so as to compensate for irregularities in the motion of the horse. The arrangement by which the grain is conveyed from the hopper, by small cups fixed on stems, into the funnels, is also seen in the section. The ends of the funnels which deliver seed are free to move a few inches, so as to overcome inequalities in the ground. This implement is also arranged as a common horse hoe, or scarifier, by taking off the apparatus for sowing.

The most important machine of this class is the *lever drill*, which is calculated to sow at a uniform depth in uneven soils; it is, however, expensive.

In the annexed figure (9) the box for sowing manure is not added, as it is in the Northumberland drill. The drill is supported on a frame and two wheels. The box A, which holds the seed, lets it down gradually into a lower part, in which the cylinder, which has the small cups fixed to its circumference, is turned by the wheel D. By means of the lever G this may be raised so that its teeth are freed from those of the wheel E, and the motion of the cylinder is stopped. The coulters which make the drills are each fixed to a lever, at one end of which, B, a weight is fixed to press the coulter into the ground. Each coulter has a separate lever, so that it adapts itself to all the inequalities of the soil. A chain proceeds from the end of each, and may be wound round a cylinder, C, by turning the handles fixed to it at H, where there is also a racket-wheel to prevent its unwinding. The intent of this is to raise all the coulters out of the ground when the drill is not intended to act, or is moved from place to place. When the drill is used, the box A is filled with seed, and the slide in it so adjusted as to supply it regularly; the lever G, which was fixed down, is raised, and the wheel D connected with the wheel E. As the horses proceed the cylinder turns, the cups take up the seed, and throw it into the funnels, K K, which conduct it to the drill behind the coulter. A light harrow or a bush-harrow follows, which covers the seed. In very loose soils the roller completes the operation.

Other forms and modifications of this class of machines exist; thus, a patent was taken out by Mr. Hornsby for a drill to sow at intervals instead of along the whole line. In the United States, drills have not been much used; *Bement's* is similar to the one in *Fig.* 1, and is somewhat employed for beans. Messrs. Pennock, of Pennsylvania, have a patent for a grain drill of considerable merit and success.

From the neglect with which such contrivances have been treated, some may suppose that they are not of much value; this is by no means the case, as the following summary by Mr. Binns shows:

1. The seed is delivered with regularity.
2. It is deposited at proper depths.
3. The weeds, during the growth of plants, are destroyed with great facility.
4. The plants cultivated receive the undivided benefit of the soil and manure, and have not to maintain a constant struggle with weeds.
5. The land, by the process of hoeing, is undergoing preparations for another crop.
6. The necessity of summer fallowing is avoided.
7. By admission of the sun and air between the rows, a stronger and healthier plant is produced, and of course a heavier crop.
8. By stirring the soil it is more susceptible of benefit from the atmosphere, imbibing more oxygen, and being both warmed and enriched by the sun.
9. The roots shoot freely in pulverized soil.
10. By drilling, the farmer is enabled to have heavier crops of beans and wheat on light land.
11. Clover and grass seeds answer

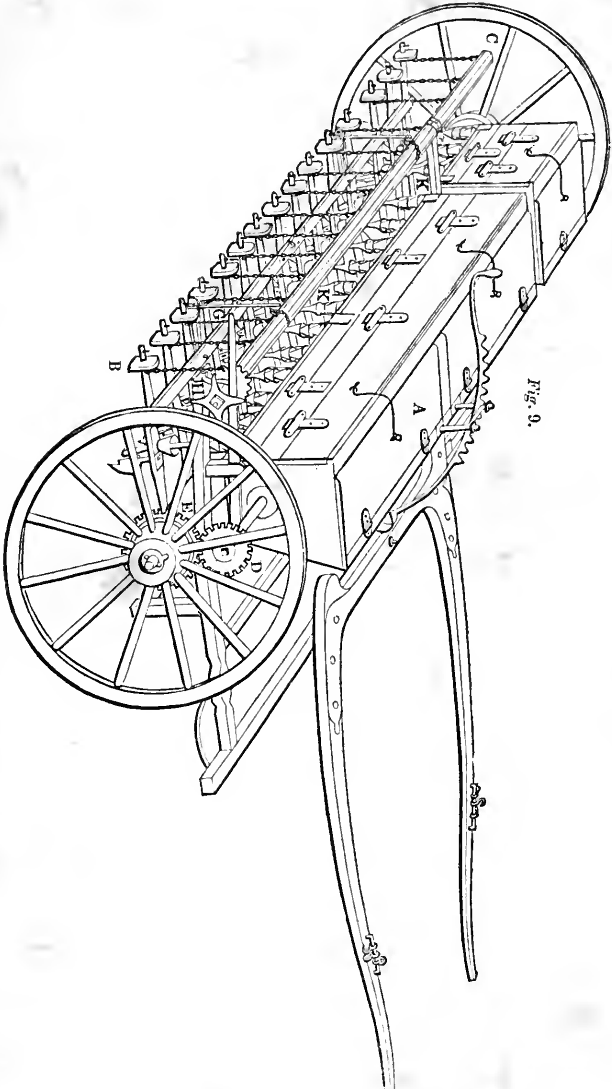


Fig. 9.

incomparably better in the pulverization produced by hoeing, independent of the clearness from weeds.

12. The drills give facility for depositing smaller portions of manure with greater effect.

A saving of half the seed is also effected. But, on the other hand, the expense of hoeing wheat, &c., very much increases the price of cultivation; although it is, according to the evidence of practical men, repaid by the large increase of crop.

The soils most benefited by this operation are light, sandy, and calcareous; on clays, the treading causes too much stiffening.

Such crops as beans, pease, cotton, turnips, carrots, and beets are now most usually sown in drills with the greatest advantage. Such rough seeds as carrots require to be first well rubbed with sand to remove the spines.

DRILL ROLLER. A roller furnished with a number of sharp rings projecting from the surface, which cut the earth and leave drills to sow seeds in: it is only suitable on light soils.

DROPSY. See *Horse*, &c.

DROSOMETER (from *δροσος, dew*, and *μετρον, a measure*). Any arrangement for measuring or weighing the quantity of dew falling at any given time. Dr. Wells's contrivance is the simplest; he exposed a known weight of dry wool, and afterward weighing it when saturated with dew, obtained a measure of the increase of moisture.

DRUPE. In botany, a one-celled, one or two seeded, fleshy fruit; as the cherry, plum, peach.

DRY DISTILLATION. The same as *Destructive Distillation.*

DRYING OIL. This usually means linseed oil which has been boiled with white-lead. It forms the basis of many paints.

DRY ROT. A rotting or decay of wood, whereby it falls gradually into powder. It is produced by the action of numerous parasitical fungi, probably of the genus *Sporotrichum.* It is most usually seen in the new wood, and in damp situations, and may be perfectly prevented by saturating the timber with several metallic solutions, of which *blue vitriol* (sulphate of copper), acetate of iron (*pyrolignate*), and corrosive sublimate are most certain. Allowing wood to be immersed in a cream of lime, in tar, &c., for some weeks, or perfectly drying and slightly charring the timber, is an easy preventive. The methods of preservation by using metallic solutions are termed Kyanizing, and are now accomplished with extensive machines, for the purpose of expediting the penetration of the fluid. In these cases the albumen of the wood, which is most liable to change, is disorganized and rendered nearly incorruptible. See *Preservation of Timber.*

DRY STOVE. A hot-house, in which the air is kept very dry for tropical plants derived from arid climates, as cactuses.

DUCK. Many species of the genus *Anas.* The common duck is economical; one drake serves eight females. The house should be clean and provided with nests. They are very fond of insects, and slugs, toads, &c. The female lays from fifty to sixty eggs during March to May; she sets a month, and should be sparingly supplied with moist food and kept away from disturbance. The young should not be allowed to go to the water at first, but supplied with a little in a hole: the duck must be kept cooped. The ducklings are first to be fed on bread crumbs soaked in milk, and subsequently used to meal and herbs. The feathers are valuable, and should be plucked as soon as the animal is dead: September and October are the best times. It is usual to hatch ducks' eggs under hens, which are better nurses. The Muscovy being larger, is preferred to the common duck by many, but is not as tender.

DUCTILITY. The property of being drawn or beaten into a fine film. Gold, platinum, and silver are the most ductile of metals.

DUCTS. The tubes or tubular vessels found in the wood, roots, leaves, &c., of plants, which do not contain a fibre capable of unrolling. They are marked with dots, bars, &c., and are probably the channels in which some part of the ascending sap flows.

DUMOSE (from *dumus, a bush*). Bushy.

DUNES. Hillocks of drift sand found on the seacoast of New-England and elsewhere. They are very destructive to agriculture, and are to be arrested only by growing long-rooted reed grasses, trees, &c., on them. Species of *Arundo* and *Elymus* have thus been made to arrest their advancement towards cultivated lands.

DUNG. See *Farm-yard Manure*, *Night-soil*.

DUODENUM. The intestine immediately next to the stomach.

DURA MATER. The fibrous covering of the brain.

DURAMEN. The heart wood.

DURHAM CATTLE. See *Cattle*.

DWARF TREES. The art of cultivating fruit-trees of moderate or dwarf size in the place of large, natural standards is an important point in horticulture. Dwarfs are procured by grafting on slow-growing, small varieties, as the apple or pear on the quince stock; by raising seedlings in pots, and transplanting into poor, barren soils, or by causing a branch to take root and allowing it to fruit as early as possible. Lopping off the upright branches is the more common method of hindering trees from growing too lofty. Fancy gardeners often procure ornamental dwarfs of the orange by grafting a cutting with flower buds on a root and allowing it to fruit. The Chinese are very curious in the cultivation of ornamental dwarfs; the following is the method employed by them:

"The extremity of a branch, two or three feet in length, in a fruit or flower bearing state — for example, the points of the branches of a fir-tree bearing cones, or of an elm bearing blossom buds—being fixed on, a ring of bark is taken off at the point where it is desired that the roots should be produced. The space thus laid bare is covered with a ball of moist clay, which is kept moist by being covered with moss, which is occasionally watered. In the course of two or three months in some trees, and of a year or two in others, roots are protruded into the ball of clay. The branch may then be cut off below the part from whence the roots have been protruded, and the branch being planted in a pot of poor soil, and kept sparingly supplied with water, it will remain nearly in its present state for many years, producing leaves, and, perhaps, flowers, annually, but never shoots longer than a few lines."

DYEING. See *Cotton Dyeing*, and the different colours.

DYER'S BROOM. See *Wood Waxen*.

DYER'S WEED. Weld.

DYKE. A low earthen wall; an embankment. In geology, a mass of condensed mineral matter, such as granite, porphyry, basalt, trap, &c., found intersecting strata, and evidently produced by injection, in a molten condition, through the strata. They have been formed during violent earthquakes, and are very important as forming an impervious barrier to the drainage of land, and giving rise to springs on hillsides.

DYNAMICS (from δυναμις, *power*). The science which examines the laws and conditions of motion, in contradistinction to mechanics, which investigates the conditions of rest and action of forces not producing motion.

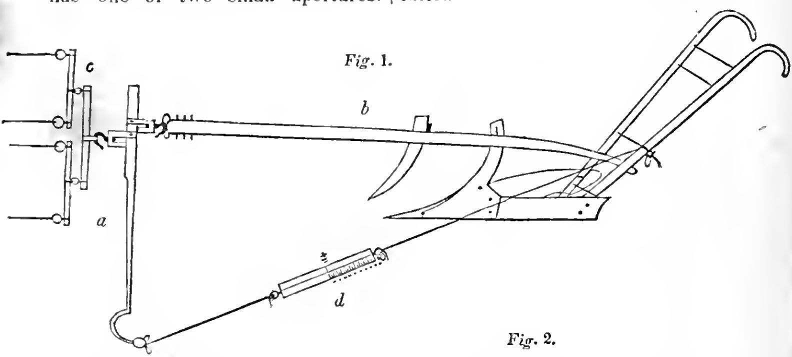
DYNAMOMETER (from δυναμις, and μετρον, *a measure*). An instrument for the purpose of measuring the amount of strength or force exerted in any draught, &c. In ascertaining the draught for ploughs and other agricultural implements, dynamometers are now regularly introduced. The commonest is Regnier's, consisting of two semi-elliptical bars of steel welded together at the ends, one of which is affixed to the clevis of the plough and the other to the hook of the swinging trees. As draught is made the springs are pulled closer together, and set an index in motion over a clock face marked into pounds and hundreds. Leroy's implement is a strong spring enclosed in a box of cast iron, and in every respect similar to Salter's spring balance.

The objection urged against these dynamometers is, that the inequalities of the soil produces so much vibration in the index that no satisfactory measures can be made. The following contrivance to obviate this is the best proposed:

"The improvement consists in the attachment of a small brass pump filled with oil, the piston of which has one or two small apertures. There being no outlet from the pump, it is evident that when any shock occurs, caused by a stone, root, &c., the oil having to pass from one side of the piston to the other, the suddenness is greatly diminished by the resistance, producing a corresponding effect upon the pointer, which, as these shocks are rapid, vibrates nearer the actual draught of the machine, which is the object in view, and not the measurement of any impediment, but a mean result of the whole."

Fig. 1 represents an extemporaneous dynamometer recommended by Mr. Cone, in the American Agriculturist.

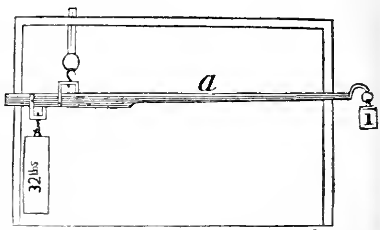
Fig. 1.



b is the beam of the plough; *c*, common swinging trees; *a* is an ordinary steelyard hitched on to the clevis and trees: the end of the yard is fastened to a line which passes from the hook of a common spring balance, *d*, the other end of which is also attached to another line tied to the left handle of the plough. When the horses pull, the steelyard lies in the line of draught, and therefore draws upon the balance, the sliding rod of which is pulled out to an extent proportionate to the draught.

For the purpose of making uniform implements, Mr. Cone proposes that the steelyard be constructed so that 1 lb. shall equipoise 32 lbs. near the point of suspension, as in *Fig.* 2. Adopting this, the measure of draught is readily made; for if the spring is drawn out to 10 lbs., we multiply by

Fig. 2.



32, and add 10 lbs., so as to make the draught 330 lbs.; the number of lbs. indicated by the spring is always added to the sum, for that weight would be necessary at the beam end to balance it, and must not be omitted. Any steelyard answers; and we may fasten the line at any convenient mark, taking care afterward to multiply the weight on the yard by that on the spring, and adding as many lbs. as would be necessary to balance the steelyard. This is, however, only a coarse measure for the convenience of the farmer, to enable him to ascertain the draught of two different ploughs, &c.

DYSENTERY (from *δυς*, *difficulty*, and *εντερα*, *bowels*). A looseness of the bowels, attended with great pain and loss of strength, and endemic. See *Horse*, *Ox*.

DYSPEPSIA (from *δυς*, *difficulty*, and *πεπτω*, *I digest*). Disordered digestion, loss of appetite, unnatural appetite, &c. It is to be repaired by simple diet, temperance, and exercise.

DYSPNŒA (from *δυς*, *difficulty*, and *πνεω*, *I breathe*). Difficulty of breathing: a symptom of disease of the chest or heart.

E.

EAR. In a horse, the ears should be small, narrow, straight, and the substance of them thin and delicate. They should be placed on the very top of the head; and their points, when pricked up, should be nearer together than their roots. When a horse carries his ears pointed forward, he is said to have a bold or brisk ear. In travelling, it is considered an advantage when the horse keeps them firm.

EARS OF GRAIN. The spike of wheat, corn, barley.

EARTH. In chemistry, those metallic oxides which are colourless, nearly or quite insoluble in water, the metallic basis of which is obtained only with difficulty, and rapidly oxidizes, are termed earths. The entire list includes but ten species: lime, magnesia, baryta, strontia, alumina, glucina, thorina, zirconia, yttria, and silica; but of these lime, alumina, and silica form the bulk of the soils and rocks of the globe. Magnesia is also rather abundant, but most of the remainder are very rare bodies. With the exception of silica, which is an acid, they are bases. See the earths separately.

EARTHS, PHYSICAL PROPERTIES OF. The power of absorbing moisture and heat, of transmitting fluids, and drying into dust or a hard mass, are termed the physical qualities of soils, and contribute, in a great measure, to their fertility. This subject has been well investigated by Mr. Schubler.

Capacity for holding Water. — If soils of different kinds be wetted until the fluid drops, it will be found that

lbs.	lbs.	
100 of dry sand retain	25	of water.
100 of calcareous sand	29	"
100 of loamy soil .	. 40	"
100 of clay loam .	. 50	"
100 of strong clay	. 79	"
100 of peat	100	and more.

Good soils hold from forty to fifty per cent. of water.

Absorbing Power. — Soils not only hold water, but absorb it from the air unequally. Thus, a quantity spread out to the same extent,

	lbs.	
of sand, absorbed .	0	of water,
of calcareous sand .	3	"
sandy loam . . .	21	"
strong clay . . .	30	"
garden mould . . .	35	"

In the same way, they retain moisture very unequally, sand losing it four times more rapidly than mould.

Absorption of Gases.—A well-tilled soil is continually absorbing from the air gaseous matter, and its fertility is, in a considerable degree, connected with this property. According to Mr. Schubler, mould absorbs eleven times, and clay nine times as fast as sand.

Absorption of Heat. — Black, well-tilled, and drained soils become more rapidly heated, and to a greater degree than such as are wet, of a light colour, or baked. In the same way, those that heat rapidly, cool rapidly, and are more subject to frosts. By experiments, mould cools in one third the time, and clay in two thirds the time of sand; so that, if they be equally heated, the sand will be warm for hours after the mould is cold. Hence the latter absorbs dew and contracts frost much more quickly than sandy soils.

Adhesiveness, or the toughness of lands, is of moment in working. Mr. Pusey measured the force necessary to draw the same plough through different soils, and found it for a

peat soil	280	pounds,
sandy loam . . .	250	"
loamy sand . . .	230	"
clay loam . . .	400	"
strong clay . . .	661	"

When this is considerable in point of expense, it appears that it requires nearly three times as much money to turn a clay as it does a sandy soil.

The physical qualities, when imperfect, can be modified. Sand, vegetable matter, charcoal, and lime, are used to lighten soils; clay and marls to stiffen those already too porous. The character of any field depends, in a great measure, upon the subsoil; for upon a very porous subsoil a stiff clay is good to retain a large quantity of water, whereas very light lands are greatly improved by an impervious subsoil.

EARTH EATING. Horses and oxen frequently eat a small amount of earth. This, if persevered in, indicates disordered digestion. It is supposed by Youatt that the earth may serve as a gentle purge.

EARTH NUTS. Numerous bulbs are edible, and hence are called earth nuts. The principal is the *Pindar*, which see.

EARTH-WORM. *Lumbricus terrestris*. Earth-worms are, on the whole, serviceable to soils, by loosening and perforating them, and are said to injure plants and seeds but little. They indicate rich soil. Salt, applied at the rate of ten bushels the acre, or a heavy liming, destroys them effectually for a season.

EARTHY MANURES. Marl, lime, clay, and sand are so called. They should rather be termed amendments, since they serve to give the soil new mechanical qualities.

EARWIG. *Forficula auricularis*. A troublesome insect in Europe, but rare in the United States.

EBULLITION. Boiling. The boiling point of different fluids is often of great importance. Water boils at 212°, alcohol at 176°, sulphuric acid at 600°, Mercury at 662°, linseed oil at 640°, oil of turpentine at 316°, nitric acid at 248°, and ether at 100°.

EDULCORATION. A chemical term, meaning the repeated washing by pure water of precipitates or powders until they are freed from soluble impurities.

EFFERVESCENCE. The disturbance made in a fluid by the escape of gas.

EFFLORESCENCE. Some salts, like carbonate of soda or soda ash, by exposure to air lose their transparency, and become white, crumbling into powder. This is termed efflorescence. The same expression also designates the appearance of crystals upon earthy, rocky, or other mineral surfaces.

EGGS. The white is a solution of albumen with soda, and contains 85 per cent. of water; the yellow consists of 28·75 fat, 17·5 albumen, 55 salts, and the rest water. They are eminently nutritive. Eggs are preserved by being packed, with the small end downward, in salt; they are also dipped into a cream of lime. The box in which they are packed should be turned upside down every two or three weeks, to hinder the yolks from settling. The duty on eggs in England of two cents a dozen may render their exportation profitable; immense numbers are now sent there from France. Eggs are readily hatched by artificial heat, and a machine called the "Eccaleobion" has been exhibited for this purpose, in which steam is used.

EGG PLANT. *Solanum melongena*. The purple kind is used for culinary purposes, and is much esteemed by many persons: the white, bearing a fruit very similar to a hen's egg, is ornamental. The seed must be sown in a hot-bed in March, and the plants taken with a ball of earth, and set out in warm weather (April or May), about two feet apart; they require a rich, warm soil, and bear, in August and September, fruit often as large as a large muskmelon. The fruit of the white is used in France as food. As they contain an acrid principle, care is taken in the cooking to remove it; this is done by warming thin slices in water, or allowing it to steep in salt and water over night, draining off the fluid, washing well in fresh water, and then frying in batter, &c. An ounce of good seed yields 4000 plants. The utmost care is necessary to preserve the young plants from being chilled to death in the Northern States: it is altogether a tender vegetable.

The *S. insanium*, or downy egg plant, is occasionally cultivated in the United States.

EGYPTIAN CORN. *Sorghum.* An annual resembling broom corn, but producing a large, exposed ear, with small, brown grains, condensed together. It is to be planted and managed like corn, but may be set rather closer. The yield of grain is from 75 to 100 bushels; it is recommended for poultry. The fodder appears to be inferior to that of Indian corn, and, excepting the yield, there does not seem to be anything to induce the cultivation.

ELAIN (from *ἔλαιον, oil*). The fluid oil existing in fats, &c., which may be separated by pressure, by cold, or by digesting in seven or eight times its weight of boiling alcohol, which acts upon the fat or tallow in such a way that the elain floats above the alcoholic solution, and the solid, or stearin, sinks below when cold. See *Fats*.

ELASTICITY. The power certain bodies possess of returning back to their original bulk or position when bent or compressed. Gases are the most elastic bodies known, fluids the least, and metals differ exceedingly in this respect.

Heating metals to a certain point and suddenly cooling by immersion in water imparts elasticity in some cases; steaming timbers also increases the quality, for the time, in a great measure.

"The principal phenomena of elastic bodies are the following: 1. That an elastic body (the elasticity being supposed perfect) exerts the same force in endeavouring to restore itself as that with which it was compressed or bent. 2. The force of elastic bodies is exerted equally in all directions, but the effect chiefly takes place on the side on which the resistance is the least. 3. When an elastic solid body is made to vibrate by a sudden stroke, the vibrations are performed in equal times, to whatever part of the body the stroke may be communicated. Thus, sonorous bodies always emit sounds of the same pitch; and the difference of the pitch depends on the greater or less frequency of the vibrations of the sonorous body. 4. A body perfectly incompressible cannot be elastic, therefore bodies perfectly solid can have no elasticity; and hence, also, the small degree of elasticity belonging to the liquids, which are eminently incompressible."—(*Brande.*)

ELATER (from *ελατηρ, a leaper*). A genus of spring beetles; they are vegetable feeders, the larvæ doing occasionally much mischief to garden plants by gnawing the roots. The *Elater noctilucus* is our common firefly, the *E. lineatus* the wire-worm insect.

ELATERIUM. *Momordica eleterium.* Squirting cucumber. An indigenous annual vine, bearing a small fruit like the cucumber, the juice of which is a drastic purge.

ELBOW. The shoulder-joint of cattle. A bend in carpentry.

ELDER. Two varieties are indigenous to the United States: *Sambucus Canadensis*, the common pest of hedge-rows and margins of ponds, and *S. pubescens*, bearing a red berry, common in the mountains of Pennsylvania. The black elder is of considerable economical value; the juice of the berries, fermented with sugar, forms an agreeable wine; a decoction of the fresh leaves is very obnoxious to insects, and may be extensively used in the garden; it is also offensive to moles. Sheep are said to select the leaves as a natural remedy in rot. The plants, which grow from eight to fifteen feet high, are recommended as a cheap hedge. On the other hand, it is a great nuisance on wet lands, from the rapidity of its growth, but may be destroyed by cutting down two or three times during the summer, and grubbing in the fall.

ELDER, BOX. A common name for the ash-leaved maple.

ELECAMPANE. *Inula Helenium.* A naturalized composite perennial, yielding roots with a bitter, aromatic taste. It is of little importance.

ELECTIVE AFFINITY. A chemical term, meaning the preference exerted by a body to combine with another in place of one already in union. Thus, potash will unite with sulphuric acid, although it be already combined with iron; the iron is separated, and gives place to the potash, which is preferred or elected. It is governed by electrical forces, like all other cases of chemical union.

ELECTRICITY. A peculiar influence or force, which is made evident by attracting light bodies, producing a spark, or jarring the body of animals. Some consider it material, although its weight cannot be measured; hence the term *imponderable*, applied to electricity, light, and heat.

"This truly extraordinary power of matter, independent of the interest that always belonged to it, has of late years acquired much importance, from its influence over chemical phenomena and its connexion with those of magnetism. When a clean glass tube is rubbed with the dry hand, or with a piece of silk, it attracts and repels any light substances—such as feathers, bran, or little pieces of paper—which are brought near it; a stick of sealing-wax rubbed upon dry flannel exhibits the same appearances, and, to a superficial observer, seems to be exactly in the same state as the glass; and they are said to be electrically *excited*. But, on more close examination, it is found that when the light bodies are *attracted* by excited glass, they are *repelled* by excited sealing-wax, and *vice versa*, so that the glass and wax are said to be in *opposite electric states*; and hence the terms *vitreous* and *resinous*, or *positive* and *negative* electricity. But these two states are always coexistent; thus, when the glass is rubbed by silk the glass becomes positive, but the silk becomes negative; and in the case of sealing-wax rubbed by flannel, the wax is negative, but the flannel is positive.

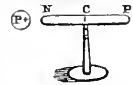
"A similar excitation of electricity is seen in an infinity of other cases; as when we rub a cat's back with the hand, or a piece of silk riband is drawn briskly between the fingers, or a sheet of paper rubbed with India rubber, or a metal rod with a silk handkerchief. These, and other extraordinary phenomena connected with them, are hypothetically referred to the presence of a peculiar form of matter, called the *electric fluid*; it is supposed to appertain to all matter, but to become evident only when in redundance or deficiency. When glass is rubbed with silk, the equilibrium of the electric fluid is disturbed, the silk imparts it to the glass; and hence the former, losing electricity, becomes *minus* or negative, and the latter, acquiring electricity, becomes *plus* or positive. This is commonly called 'Franklin's theory,' having been proposed and defended by that celebrated electrician. Others have assumed the existence of *two fluids* as essential to the explanation of electrical phenomena; both equally subtile, elastic, and universally diffused, and each highly repulsive as to its own particles, and attractive of those of the opposite kind. Electrical quiescence is referred to the combination of these fluids and their consequent mutual neutralization; and electrical excitation is the consequence of either being free or in excess. It is supposed that they are separated by friction, and by all those other causes which give rise to the appearance of free electricity. Either of these hypotheses may be adopted as facilitating the explanation of electrical phenomena, and as conferring meaning on terms which would otherwise be unintelligible: of the two, the simplest, or that which refers the phenomena to one fluid, is perhaps the most generally applicable. Both are, apparently, equally consistent with facts; but the existence of any *fluid*, or form of matter, as the cause of electrical phenomena, is at best extremely problematical.

"There are two series of distinct phenomena represented by electrified bodies: the one seems to result from the accumulation of electricity upon the surface of bodies; they are commonly included under the term *electricity of tension*, and are well exhibited by the common electrical machine and its prime conductor. It affects all neighbouring bodies; and they are thrown by it into a polar electrical state, by what is termed *induction:* it has a tendency to pass off in sparks through the air, or gradually to escape from points. The thunder-storm furnishes a magnificent specimen of this state of electricity. The other state of sensible electricity is that exhibited by *electricity in motion;* as when a current of electricity is passing through a wire or other conducting medium: in this case a vast *quantity* of electricity may be concerned in the phenomena without any apparent *intensity;* but while the current is continuous it produces magnetic phenomena of a most extraordinary character; and when the perfect conductor is broken by the intervention of certain other media, they suffer, in some cases, chemical decomposition, and in others become heated, and even ignited. The phenomena of electricity in motion are best exhibited by the Voltaic apparatus.

"In all electrical experiments, remarkable differences are observed in respect to the transfer of the electric fluid through different bodies: some, such as the metals, allow its free and nearly unimpeded passage through their substance; while others receive and retain it more superficially, such as glass, resin, and other substances which exhibit attractive and repulsive powers when rubbed. Hence the division of bodies into *conductors* and *non-conductors*.

"Many most important electrical phenomena depend, apparently, upon *induction*, a subject which has been ably studied by Faraday. We shall here enter into such details only as are required to render some of the principal terms employed in discussing electrical phenomena intelligible.

"If P + represent a metallic sphere in a highly positive electric state, and N P a metallic *conductor* in its vicinity *insulated* upon a glass stem, it will be found that the extremity N of N P is *negative*, while the other extremity, P, is *positive*, and that these opposite electricities are greatest at the extremities of the conductor, and gradually diminish towards the centre line, C, which is neutral.



This extraordinary state of excitation in N P is entirely dependant upon the proximity of P +; for if P + be withdrawn, N P loses all appearance of electricity; and the degree of excitement in it is directly proportional to the extent to which P + is excited, and (within certain limits) to its nearness to N; so that fluctuations in the electricity of N P will be observed in proportion as P + is brought towards or removed from N, provided they are not brought into *contact*, and that no *spark* passes. These phenomena have been theoretically explained upon the supposition that the free electricity in P + disturbs the equilibrium of the natural electricity of N P, and, by repelling it from N to P, leaves the former *minus* and the latter *plus*. Or, if we assume the existence of two electric fluids, then the free positive electricity of P + *repels* the positive fluid of N P, and *attracts* its negative fluid, throwing it into an *electro-polar* state. If N P, instead of being insulated, be connected by its extremity, P, with the ground, the accumulation at P is prevented, while N retains its deficient or negative state; or, upon the other theory, the positive fluid at P is neutralized by a supply of negative fluid from the earth; and if, after having effected this by momentarily touching N P with the finger, we suddenly remove P +, the insulated conductor, N P, will be left with an excess of negative electricity.

"It will be obvious, from the above statement, that when light bodies, especially if they be conductors, are attracted by electrified surfaces in their vicinity, they are thrown by induction into opposite electrical states; and when the hand is brought near the excited conductor of the electrical machine, it becomes negative, and remains so until the equilibrium is restored by the passage of a spark; which phenomenon is supposed to be the result of the combination of the two electric fluids.

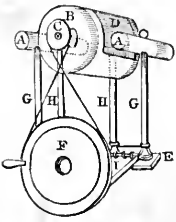
"Many important phenomena of

electrical accumulation are explained by reference to the principles of induction, and among them the action of the *Leyden jar*, or vial. A thin glass jar, or bottle, A, is coated inside and out, to within three or four inches of its mouth, with some conducting substance; tin foil, being especially convenient for the purpose, is generally used; and a metallic rod, projecting a few inches from the aperture, and surmounted by a brass ball, B, communicates with the interior coating.

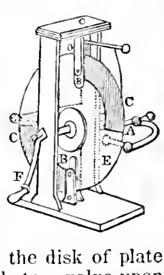
"When the ball is applied to the prime conductor of the electrical machine, and the outer coating communicates with the ground, the interior acquires a positive and the exterior a negative charge; and on making a communication by means of a conductor between the inner and outer coatings, the electricities are annihilated with the production of a bright spark and explosion, and by a most disagreeable sensation, called the *electric shock*, if the body be made part of the *circuit*. When several jars are so arranged that their interior and exterior coatings are all separately connected, the assemblage constitutes the *electrical battery*.

"In the common *electrical machines*, electricity is excited by the *friction* of the plate or cylinder of glass upon the cushions or rubbers; and the glass becomes positive, and communicates the same state to the opposed conductor, generally termed the *prime conductor* of the machine; the rubber becomes negative, and is sometimes connected with a second conductor.

"The annexed figures represent



the two common forms of the electrical machine. The first is the *cylinder* machine, commonly called Nairne's machine. B is the glass cylinder, which is made to revolve upon its axis by the multiplying wheels, F C, the necessary friction for the electric excitation being produced by the cushion and silk flap, D. A A are the positive and negative conductors: the latter, bearing the cushion, is adjusted as to its requisite pressure upon the cylinder by the screw at E. The conductors are respectively supported and insulated by the glass pillars G G, which should be coated with lac varnish; and the axis of the cylinder rests upon the pillars H H, which are also of glass. The second figure represents the *plate* machine, usually termed Cuthbertson's machine, in which A

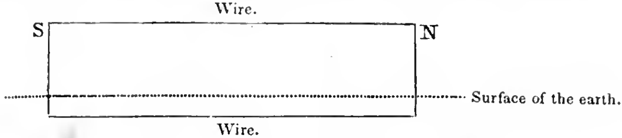


is the prime conductor, borne by a stout glass stem which is attached to the frame of the machine. B B are the upper and lower pairs of cushions, by which, together with the silk flaps, C C, the necessary friction is obtained. E is the disk of plate glass, which is made to revolve upon its axis by the winch F. In this machine, as the cushions or rubbers are not insulated, the negative electricity cannot be separately accumulated or exhibited, as in the cylinder machine.

"There are many other and highly important causes of electric excitation than those above adverted to;

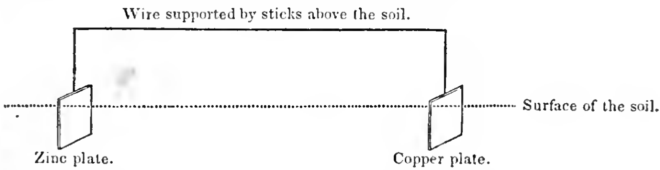
such as contact of different metals." See *Galvanism*.—(*Brande's Dict.*)

ELECTRICITY APPLIED TO AGRICULTURE. Much interest has been taken of late in the application of this agent to forwarding garden vegetables, and indeed field crops. Two plans are pursued. Wires are supported upon a trellis running north and south, at a height of four or six feet; at the ends of each trellis they are bent down to the ground and about three inches below it, and are conveyed at this depth through the soil, from one to the other end, so that the wire forms a parallelogram, thus:



A number of these, at distances of two to four feet, are arranged through the field, and the grain or plants sown on the soil or in drills. It is stated on good authority that rye, oats, wheat, &c., so treated are singularly developed and advanced in maturity: it may be worthy of trial. In this case the atmospheric electricity is supposed to act.

The second plan is a galvanic arrangement, but may be best introduced here. Large plates of sheet copper and zinc are used, the size depending upon the distance at which they are placed: 18 inches deep and three feet long may be used at a distance of 50 feet; these are sunk into the soil vertically, excepting three inches of the top, which is left exposed; from one to the other passes a stout copper wire, which is well soldered to both and sustained by a few sticks or a trellis. Such an arrangement may be made to enclose four or five drills of potatoes, carrots, parsnips, &c. The fluid of the earth, acting on the zinc, produces a corrosion, which gives rise to the galvanic or electric current that traverses the soil, and is said to cause plants to grow very rapidly. This experiment, tried with potatoes by Mr. Ross on Long Island, was very successful, in his opinion; it is so manageable and cheap as to be worthy of consideration to market gardeners. The whole will appear thus:



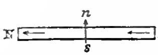
ELECTRODE (from ηλεκτρον, and ὁδος, *a way*). The surfaces by which electricity passes into and out of other media have been called by Mr. Faraday *electrodes*. The term has also sometimes been derived from ηλεκτρον, *amber*, and ειδος, *like*, and applied to substances which, like amber, become electric by friction.

ELECTRO-DYNAMICS (from ηλεκτρον, and δυναμις, *power*). The phenomena of electricity in motion.

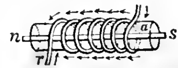
ELECTROLYTE (from ηλεκτρον, and λυω, *I set free*). Substances susceptible of direct decomposition by the action of the electric current: hence, also, the verb *electrolyze*, *i. e.*, to resolve compounds into their elements by the agency of electricity. Faraday has shown that in many supposed cases of electrolysis the evolution of elements is the consequence of a secondary action; the sulphur, for instance, which is thus evolved at the negative pole from sulphuric acid, is the result of the evolution of hydrogen at that pole. In all cases of true electrolytic action, sulphur appears at the anode.

ELECTRO-MAGNETISM. When a current of electricity is traversing any substance, or when electricity is in motion, magnetism is at the same time developed. This fact was first observed by Professor Oersted of Copenhagen, and has become the source of an important series of discoveries included under the above term. The excitation of magnetism depends upon *quantity* of electricity, and is best observed in the wire which closes the voltaic circle, especially of one or more pairs of large plates. If a magnetic needle be brought near a wire through which an electric current is passing, it will immediately deviate from its usual position, and assume a new one, dependant upon the relative position of the needle and the wire. On placing the electric wire *above* and parallel to the magnet, the pole next the negative end of the battery always moves to the west; and when the wire is placed *under* the needle, the same pole turns to the east. When the electric wire is on the same horizontal plane with the needle, no declination takes place; but the magnet shows a disposition to move in a vertical direction, the pole next the negative side of the battery being depressed when the wire is to the west of it, and elevated when it is to the east.

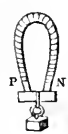
The magnetic phenomena of a wire transmitting electricity are such as appear to depend upon the circulation of magnetism at right angles to the electric current, so that if N P represent the



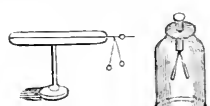
wire transmitting a current of electricity in the direction of the horizontal darts, a current of magnetism will be established in the direction of the vertical dart, appearing to move round the axis of the electric current; hence the term *vertiginous* or rotary magnetism, applied to these phenomena; and hence the motion of the pole of the magnet round the electric wire, or of the electric wire round the pole of the magnet, when they respectively are so arranged as to be able to move freely in any direction. If a steel needle be placed in contact with the electric wire, and parallel to it, it acquires opposite magnetisms upon its two sides; but if it be placed at right angles to the connecting wire, it becomes polar, and permanently magnetic. If the electric wire be twisted into a spiral, and the steel needle placed within it (as in the cut), it is



retained there, and becomes a more powerful magnet in consequence of the repetitions and direction of the electric and magnetic currents, as will be evident from the annexed figure, where *a* represents a glass tube with the wire *n p* conveying the electric current twisted round it, the darts at the ends of which show the ingress and egress of the electricity, and the transverse darts the direction of the magnetic current. If the cylinder round which the wire conveying the electric current is twisted be of steel, it becomes a permanent magnet; if of pure soft iron, it becomes a temporary magnet, so long as the electric current is in motion, and *s* and *n* are powerfully opposed poles. If the bar be bent, as in the annexed cut, a powerful horseshoe magnet is obtained when the ends, *p n*, of the copper wire twisted round it are connected with the voltaic circle; and a single pair of plates is sufficient for the purpose.

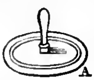


ELECTROMETER (from ηλεκτρον, and μετρον, *a measure*). An instrument for ascertaining the pres-



ence and intensity of electric excitation. The simplest form of electrometer consists of two very small pith balls suspended from a small conductor by very fine wire or thread; upon the principle that bodies similarly electrified repel each other, these *diverge* upon the reception of very minute quantities of electricity. Two thin slips of gold leaf are also similarly applied; and, to prevent the influence of the agitation of the air upon them, they are suspended in any convenient way under a glass shade. The other forms of electrometers generally act upon the same principle, being respectively adjusted to the varying degrees of quantity and intensity.

ELECTROPHORUS (from *ηλεκτρον*, and *φερω*, *I carry*). This instrument consists of a flat, smooth cake of resin, A, which is rendered negatively electrical by friction; a plate of brass with a glass handle is then placed upon it, and becomes electropolar by induction. The brass plate, having been touched by the finger while lying upon the resin, is afterward lifted off by its glass handle, and gives a spark of positive electricity. The same operation may be indefinitely repeated. This instrument is sometimes a convenient substitute for the electrical machine, and is elegantly applied to inflame a jet of hydrogen gas in *Volta's inflammable air lamp.*



ELECTROPOLAR. A term applied to conductors, one end or surface of which is positive, and the other negative: a state which they commonly exhibit when under the influence of induction.

ELECTROSCOPE (from *ηλεκτρον*, and *σκοπεω*, *I see*). An instrument for rendering electrical excitation apparent by its effects. The gold leaf electrometer and other similar arrangements are *electroscopes*.

ELECTUARY. Any medicine of a thick or solid consistence, made up with sugar.

ELEMENTS. In chemistry, bodies which have never been decomposed or resolved into their components by means we possess. Hydrogen, oxygen, sulphur, nitrogen, phosphorus, chlorine, and the metals are the commonest elements. There are 54 already known.

ELEVATION. In architecture, the representation of the vertical view of any building, &c.

ELLAGIC ACID. The insoluble gray powder which subsides from an infusion of galls; it is isomeric with gallic acid, $C_7 H_3 O_5$.—(*Pelouze.*)

ELM. *Ulmus.* The principal species are, the *Americana*, white; and *fulva*, slippery; the Thomas, *U. racemosa;* river, *nemoralis*, and Whahoo, *alata*, are also indigenous. Mr. Nuttal mentions a species resembling the sub-evergreen *Chinensis*, found on the Red River. The Chinese is an ornamental tree, to be had at the nurseries.

The *white* elm is found from Nova Scotia to Georgia, delighting in rich, wet lands; in perfection, it reaches 100 feet, with a stem of 4½ feet diameter. The bark is gray and deeply furrowed. The tree is of great beauty and stateliness, the heart wood dark brown, and ornamental, but so brittle as to be of inferior value. It is used improperly for naves, and occasionally in Maine for keels. The bark, soaked in water and pounded, furnishes bass for the bottoms of chairs.

The *slippery*, red, or moose elm is commonly diffused, prefers a rich but dry soil; it may attain 60 feet, by 18 or 20 inches in diameter. The wood is of a dull red, and consists in a great measure of heart: it is coarse, and splits, but is highly esteemed for blocks, railings, and building purposes, as it stands moisture tolerably well. The bark is brown, and, boiled in water, yields a mucilaginous solution used in medicine and as a drink. It resembles the European Dutch elm, but neither this nor the preceding possess the admirable qualities of the *U. campestris* of Europe.

The *Whahoo* is smaller, and a Southern tree; the wood is deep chocolate, fine, hard, and durable: it is esteemed for naves. It is remarkable, as well as the Thomas elm, for a corky excrescence on the bark. Many of this genus are highly ornamental, as the white, *campestris*, *montana*, *macrophylla*, *gracilis*, *effusa*, and *Chinensis*.

ELUTRIATION. The separation of substances by washing them in large quantities of water, so that the heavier particles fall to the bottom, and the lighter ones, remaining some time suspended, are gradually deposited in a finely-divided state.

ELYMUS. The genus of lyme grasses. They are perennial, large and coarse, mostly water or seashore plants. The *E. arenarius* is of service in binding together loose seashore sands, and resisting the encroachments of the sea. The saltmarsh grasses are frequently of this genus.

ELYTRUM (from *ελυτρον*, *a sheath*). The outer hard wings of beetles.

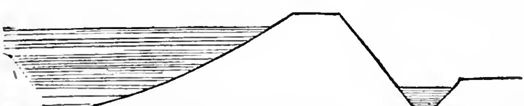
EMACIATION. The act of becoming lean. It is a symptom of diseased intestines or stomach, and should be attended to at once when set in; but a sudden change of food from that which is oily to starchy is attended with considerable falling off.

EMARGINATE. In botany, notched, having a sharp indentation on the leaf, &c.

EMASCULATE. To castrate.

EMBANKMENT. "It is often necessary to raise mounds or dikes along the course of rivers, to keep them within their channels, and prevent their flooding the lands which lie near them, when the waters rise above their usual level. Those alluvial lands which lie near the mouths of rivers, and are below the line of high water, cannot be cultivated to advantage unless they are secured from inundation by proper embankments; and as these alluvial deposites are generally very fertile, it amply repays the expense of constructing dikes and keeping them in repair The whole of the provinces of Holland and Zealand, and several other districts in the Low Countries, could not be inhabited if the sea were not kept out by strong embankments; and the destruction of a dike frequently desolates great tracts of country. The art of constructing dikes, and of keeping them in repair, is therefore one of the greatest importance to the proprietors of low lands situated as above described.

"The first thing to be attended to in forming embankments is to enable them to resist the pressure of the highest floods which are likely to occur, and to prevent the effect of the waves and currents in washing them away. When it is the simple pressure of a column of water which is to be withstood, a simple earthen bank made of the soil immediately at hand, provided it be not of a porous nature, is sufficient. Its form should be a very broad base, with sloping sides and with a flat top, which may serve as a path, or even a carriage-road, if the bank be of considerable dimensions. The side towards the water



should slope more gradually than towards the land, where it may form an angle of 45° with the horizon. A ditch is usually dug along the inside of the bank, and sometimes on both sides, when the dike is at some distance from the usual channel of the water, and is only a precaution against unusual floods. The inner ditch collects the water which is produced by rains or may find its way by filtration through the bank or the soil.

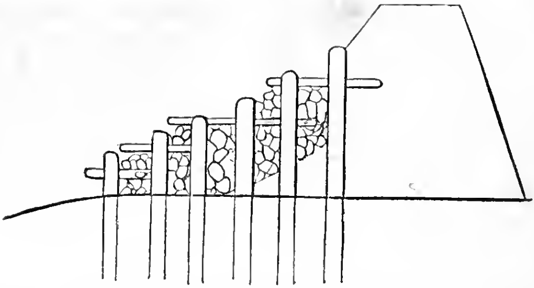
"To raise these simple dikes, nothing is requisite but to carry the earth from below, and consolidate it by treading or ramming it in a moist state, that no interstices be left. But where a considerable river winds through an extensive plain, and is apt to change its bed by the wearing away of the banks in some places and the deposition of mud in others, more skill and more expensive works are required to keep it within its banks and to prevent the effects of a rapid current in destroying them. In this case strong piles are driven deep into the ground, and, instead of earthen dikes, stone walls are opposed to the force of the water.

"The embanking of a considerable river often requires the course of the stream to be changed, and instead of the winding course which rivers naturally take through plains, straight channels are artificially made for them. At first sight it would seem that a straight channel is the natural course of a stream; but this is far from being the case: a straight course can never be maintained without artificial means; water never flows in straight lines, but always in curves. The slightest inequality in the bottom or sides partially obstructs its course, and produces a circular motion in the water; and this, acting on soft banks, soon hollows them out, which, increasing the eddies, accelerates the change in the current. When a river is turned into a new channel, the banks must be strengthened with piles of masonry, and the foundations of the works must be laid below the gravel or stones which may have accumulated, that they may not be undermined by the percolation of the water.

"When the dikes are only intended to check the waters at the time when they flow over their natural banks, it is best to raise them at some distance from the river on each side, and parallel to its course; because, in sudden floods, the water, having a greater space to flow through, will not rise so high, and will sooner recede. The natural banks must be carefully attended to in this case, that they may remain nearly the same, without being subjected to that continual change which we have noticed before. Those who have long attended to these changes and their immediate causes will find no difficulty in checking them in the outset by very easy and simple means. Whenever a bank begins to be undermined, a few piles driven in judiciously, and some stones thrown into the river above the place where its banks begin to wear away, will cause a change in the current, and throw it over to the opposite side. Indeed, if this is done injudiciously, the banks opposite will begin to wear away; but by continued attention, and prevention rather than correction, any river having a moderate current may be kept within its proper bed.

"It sometimes happens that rivers, near their mouths, form shallow estuaries, and occupy much ground which might be usefully employed. In this case an entirely new outlet may sometimes be made, through which the river may at once discharge itself into the sea; and the whole course will probably be soon filled up by the deposition of soil and mud brought in by the tides; for it is the current which clears the channel, and when this is taken away the channel soon fills up. In the course of a short time the old mouth of the river will be so filled up as scarcely to admit the tide; and an embankment across it may lay a large fertile tract of land quite dry.

"Where embankments are made against the sea, greater skill is required to resist the force of the waves. If there are materials at hand to lay a bank of stones imbedded in clay, with a broad base, and the sides sloping very gradually upward, a very safe barrier may be opposed to the waters. It is not the direct impulse which is the most destructive: waves striking against a sloping surface lose their force and rise over it; but it is in returning that they draw the materials with them, and scoop out the foundations. If the stones are well joined together, the retiring wave will have no effect in loosening them; but if any one of them can be singly removed from its place, they will soon disappear one after another, till a breach is made; after which a single storm may destroy the whole embankment. In various places the ingenu-

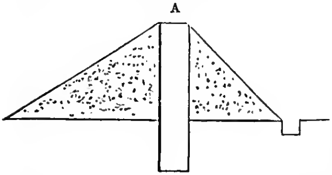


ity of scientific men has been exercised to invent various modes of resisting the force of the sea. In some exposed points piers of solid oak have been made, which oppose a smooth surface obliquely to the force of the waves; in others, rows of piles have been driven in, forming lines at right or oblique angles to the line of the shore, in order to intercept the waves and break their force before they reach the bank. In a place where the rounded stones called shingles were usually thrown up by the waves, and the bottom was a strong clay, their retreat has been intercepted by rows of strong piles driven in a line along and parallel to the shore, and covered with boards nailed to them on the land side. By this means the sea has been made to provide the materials of the embankment, and to lay them down. In one night the shingles have been thrown over the piles, and, being retained by the boarding, have formed a perfect wall. A second row of piles between the first and the sea, and a third if required, forms a sea-wall which might defy any storms. We mention this as an example of the advantage which may be taken of particular circumstances, by which a great expense may sometimes be saved. In other situations, where the shingle is not thrown up, and the wall is not so immediately exposed to the action of the waves, an excellent facing of the wall is made by several rows of piles from five to fifteen feet long, driven along the side of the earthen bank in the form of steps rising above each other. These piles are driven very close together, and the distance between the rows is about two feet. This interval is filled with stones, and bushes are pinned down over them by means of wooden pins driven horizontally through holes made in the piles. This contrivance effectually prevents the washing away of the bank.

"Where the land lies very flat for a considerable distance from the shore, it is of advantage to have two complete banks, one within the other, so that if the outer bank is broken through, the second will keep back the waters, until the first can be repaired. The ground between the two lines of banks is usually left in pasture. In this case the damage done by an inundation of salt-water will not be so great as if the land were arable; and unless it remain flooded for a considerable time, the herbage suffers little, if anything, from it.

"The water which accumulates within the banks and is collected in the internal ditch and those which divide the marshes must be let off occasionally by means of channels and sluices at the time when the tide is out, and the water outside the bank is lower than that which is within it. In small embankments a wooden trunk or pipe may be laid through the bank, with a valve opening outward, by which means the superfluous water may flow out, and none flow back. It is useful to carry this trunk a considerable way outside the bank, if it empties itself immediately into the sea, in order that it may not be choked up with sand or shingles. Cast-iron pipes are conveniently used for this purpose, and they may be carried out so far as to empty themselves below low-water mark. But when the embankment is very extensive, and there are streams flowing through the part which is embanked, larger flood-gates and more extensive works are necessary. These being opened and shut as occasion may require, serve to keep the channel clear, by producing occasionally a considerable rush of water to carry away mud and sand, which would otherwise have accumulated at the mouth of it. When the level of the land which is embanked is below the usual level of the waters which are without, the water is raised by means of engines over the banks, as is the case in the fens.

"In the forming of the banks, where the soil may not be quite impervious to water, it is useful to begin by digging a ditch in the line of the intended bank, of such a depth as to reach an impervious subsoil. This ditch is to be filled up with clay or tempered earth, and as the bank is raised, the middle of the bank should be composed of the same materials, which will thus form a vertical wall, A B, up to the top; and the more porous earth being heaped up against the sides of this wall will form the slopes of the bank; thus the whole will be perfectly impenetrable to the water. The clay should be well trod in with the



feet in a moist state, and no pieces of wood, or even straw, should be in it, for a straw may be the cause of the water finding a passage through a bank, and this passage gradually widening will soon produce a hole, which may in the end cause the destruction of the bank. Moles and worms are great enemies to dikes. In Holland the storks are held in great veneration, and are never molested, because they are supposed to destroy a species of worm which often does great mischief to the dikes by perforating them."—(*W. L. Rham.*)

EMBROCATION (from *εμβρεχα, I moisten*). A spirituous, saponaceous, or oily application rubbed on the skin to relieve pain or numbness.

EMBRYO (from *εμβρυον, I bud forth*). The growing point, eye, or chit of a seed. The young of animals in the act of development, or fœtus.

EMBRYOTOMY (from *εμβρυον*, and *τεμνω, I cut*). The cutting of the embryo or fœtus out of the womb in such cases as endanger the life of the parent.

EMERY. A sand of corundum of extreme hardness, capable of wearing down all minerals and metals except the diamond.

EMESIS (from *εμεω, I vomit*). The act of vomiting.

EMETIC. A drug producing vomiting. Ipecacuanha, tartar emetic, salt, and green vitriol are the commonest emetics.

EMETIC, TARTAR. Tartrate of potash and antimony, a white, soluble salt, emetic in doses of one to two grains, and purgative and sudorific in doses of half a grain. It reduces the activity of the circulation, and is therefore an admirable febrifuge.

EMETINE. The active principle of ipecacuanha.

EMOLLIENTS. Medicines which soothe and soften any part of the body, as warm water, &c.

EMPHYEMA (from *εν*, and *πυον, pus*). A collection of purulent matter in the chest, produced chiefly by inflammation.

EMPHYSEMA (from *εμφυσαω, I inflate*). A collection of air in the cellular tissue; hence *emphysematous*.

EMPYREUMA (from *εμπυρευω, I kindle*). An odour of burned matter; hence *empyreumatic*.

EMULSIN. A modification of albumen found in almonds and other seeds, and capable of acting in a peculiar manner on amygdalin to produce volatile oil of bitter almonds.

EMULSION. A milky liquid in which an oil is suspended, as in milk.

EMUNCTORIES. The vessels of the skin which exhale perspiration are so called.

ENAMEL. The hard ivory portion of teeth. Glass and oxide of tin fused together.

ENCRINITES. Fossil *crinoideans* resembling a lily.

ENCYSTED (from εν, *in*, and κυστις, *a bag*). Fluid or other tumours enclosed in a sack of membrane. It is necessary, in removing them, to cut out or destroy the sack also.

ENDEMIC (from εν, and δημος, *a people*). A disease or peculiarity belonging to a particular people or race.

ENDIVE. *Chichorium endiva.* The varieties are the green and white curled, yellow, and broad leaved. The green curled is earliest: sow in April and May, and for general crops, in June or July, at intervals, to suit the table or market. When the seedlings are three inches high, transplant to a good soil, and set a foot apart each way; tie up to blanch when full-sized. They must be attended to and treated like lettuce. One ounce of seed furnishes four to five thousand plants. It is a bitter salad, used raw, and also in stews: with care it may be preserved like cabbages through the winter.

ENDOCARP (from ενδον, *within*, and καρπος, *a fruit*). The middle part of a fruit: it forms the flesh of the apple, peach, cherry, &c.

ENDOGENS (from ενδον, and γεινομαι, *I grow*). Plants or trees which do not enlarge their trunks by any addition of wood exterior to that existing the year before. One of the great divisions of the vegetable kingdom, including palms, grasses, and numerous bulbous plants. The leaves are furnished with straight veins, the flowers usually divided into three parts or some multiple of that number.

ENDOPLEURA (from ενδον, and πλευρα, *the side*). In botany, the internal integument of a seed.

ENDORHIZÆ (from ενδον, and ῥιζα, *a root*). A term invented by Richard for the embryo of monocotyledons, in which the radicle has to rupture the integument at the base of a seed prior to entering into the earth, appearing as if it came from within the mother root.

ENDOSMOSE (from ενδον, and ωσμος, *impulsion*). A term invented by Dutrochet to designate the passage of fluids through membranes. Penetration is an analogous term. Whenever two fluids are separated by a membrane or tissue without sensible pores, both of which moisten it, there is a passage of each fluid, one into the other; but this is often with different rapidities, the fluid affecting the tissue most passing with the greatest rapidity. The movement continues until the mixture on each side is similar. This also occurs with gases. It is controlled by electricity, as Dr. Draper has shown.

ENDOSPERMIUM (from ενδον, and σπερμα, *seed*). A term invented by Richard to denote the albumen of seeds.

ENDOSTOME (from ενδον, and στομα, *the mouth*). The passage through the inner integument of a seed immediately below the part called the foramen.

ENDOTHECIUM. The fibrous cellular tissue lining an anther.

ENEMA. A glyster, an injection thrown up the bowels to produce purging, allay pain, &c.

ENNEANDRIA, ENNEANDROUS. Having nine stamens. See *Botany*.

ENSIFORM. Sword-shaped. A term used in descriptive botany, &c.

ENTERITIS (from εντερα, *the intestines*). Inflammation of the intestines. See *Horse*, *Ox*, &c.

ENTOMOLOGY (from εντομα, *insects*, and λογος, *a discourse*). The science treating of insects. See *Insects*.

ENTOZOA (from εντος, and ζωον, *an animal*). A tribe of worms, many of which are parasitic to the intestines and other parts of animals.

EOCENE (from ηως, *the dawn*, and καινος, *recent*). The lowest portion of the tertiary epoch of geologists, in which a few recent remains only are found.

EPIDEMIC (from *επι, upon*, and *δημος, the people*). A disease which spreads through a community, a stable, &c.

EPIDERMIS (from *επι*, and *δερμα, the skin*). A light covering over the skin of animals. The outer membrane of plants.

EPIDOTE. A common fibrous, green, or dark mineral, belonging to primary rocks, containing silica, 37; alumina, 21; lime, 15; iron, 24 per cent.

EPIGŒOUS (from *επι*, and *γη, the earth*). Growing near the earth, or on the earth.

EPIGASTRIC (from *επι*, and *γαστηρ, the stomach*). Over the stomach.

EPIGLOTTIS (from *επι*, and *γλωττα, the tongue*). A small cartilage at the root of the tongue, which protects the windpipe.

EPIGYNOUS (from *επι*, and *γυνη, a female*). Any part of a flower growing upon the top of the ovarium or fruit.

EPILEPSY (from *επιλαμβανω, I seize upon*). Falling sickness, attended with sudden fits, stupor: it soon becomes periodical, and finally terminates life. Bleeding, reduction of food, and care are necessary in full habits, but it frequently arises from injuries on the head. It is a nervous disease, little under control.

EPIPHYLLUS (from *επι*, and *φυλλον, a leaf*). Growing on a leaf.

EPISPASTIC (from *επισπαω, I draw upon*). A blistering drug.

EPISPERM (from *επι*, and *σπερμα, a seed*). The testa, or outer coating of seeds.

EQUISETUM. The scouring rush; hence *equisetaceæ*.

EQUIVALENTS. See *Atom*.

EREMACAUSIS (from *ἠρεμα, slow*, and *καυσις, combustion*). A term invented by Liebig, to express the smouldering, or dry rot, of organic matter freely exposed to the oxygen of the air and merely moistened with water. It is altogether different from fermentation, which requires little air. By eremacausis, acids, as the acetic, nitric, &c., are produced. When much nitrogen exists in the decaying matter, it is called *nitrification*, especially if lime or potash be present. The process of eremacausis is much to be preferred to fermentation in the preparation of putrescent manures, for less gaseous matter is formed, and there is less loss; it is, moreover, the natural decay occurring in the soil. See *Nitre-Beds*.

ERGOT. A disease of the grain of rye, and sometimes other grains, in which it turns black, and acquires an acrid, fungous taste. It is considered due to an insect or parasitic fungus. The diseased grain is very poisonous, producing a dry gangrene, attended with sloughing of the hoofs, horns, ears, &c., of cattle. It is of great service in medicine as a uterine stimulus.

ERICA. The genus of heaths. *Ericaceæ*, a family of shrubby plants, as the heaths, rhododendrons, azalias, &c.

ERINACEUS. A genus of insectivorous animals, including the hedgehog.

ERIOPHORUM. The genus of cotton grasses.

ERODED. Gnawed, a descriptive term in botany and zoology, meaning any jagged edge.

ERRATIC ROCKS. *Boulders*.

ERRHINES (from *εν, in*, and *ρiν, the nose*). Bodies which excite sneezing.

ERUCA. A larva, or worm.

ERVUM. The generic name of the tare and lentil plants.

ERYSIPELAS (from *ερυω, I draw*, and *πελας, adjoining*). An inflammation of the skin, attended with blisters and a burning heat; it indicates a bad, feeble constitution.

ERYTHRIC ACID (from *ερυθρος, red*). The red body produced by acting on uric acid by nitric acid; it has also been called rosacic acid, *Murexide*.

ESCHAR. A scab, cicatrix.

ESCHAROTIC (from *εσχαραω, I scab over*). *Caustic*.

ESCULENT. Edible plants, roots, &c.

ESPALIERS. "In horticulture, trees trained by lattice-work or other supports on the borders of beds, or as hedges to enclose plots of ground. They may serve to defend, in a great measure, many tender plants from the inclemencies of wind and weather. The trees chiefly planted for espaliers are apples, pears, and plums. The principal objects aimed at, however, in espaliers are to expose the foliage and fruit of the plants or trees more perfectly to the light and sun, to prevent the branches from being blown about by the winds, and to economize space by confining them within definite limits."—*Loudon.*

ESPARSETTE. *Sainfoin.*

ESSENTIAL OILS. Oils which impart flavour and odour to plants, and are readily volatilized by heat. Many, as peppermint, rose, lemon, &c., are easily distilled by placing the fresh herbs, &c., in water and applying heat.

ETERIO. A compound fruit, the ovaries of which are distinct and indehiscent, upon a dry or fleshy receptacle, as the strawberry, raspberry, &c.

ETHER. Commonly this name is applied to a highly volatile, inflammable, and aromatic fluid, obtained by distilling equal parts of alcohol and sulphuric acid. But it also represents a class of organic compounds having properties similar to ether and alcohol, and containing a common base or radical, *Ethyl* or *Ethule* (C_4H_5); of this common sulphuric ether is an oxide.

ETIOLATION. Blanching of vegetables. This is done by excluding light either by earthing, as in the case of celery, or tying up the leaves, as with lettuce, endive, &c.

EUDIOMETER (from *ευδια, calm air*, and *μετρον, a measure*). An instrument for the analysis of air and gases, especially for the determination of the amount of oxygen. Dr. Ure's is the most esteemed. Dr. Hare, of Philadelphia, is the author of a very convenient eudiometer.

EUPHORBIA. A genus of plants commonly yielding a milky acrid juice; many resemble the cactaceæ. *Euphorbiaceæ*, the natural family, including the euphorbia, crotons, castor-oil, India-rubber tree, &c.

EUPION. An inflammable, greasy liquid, obtained from tar.

EUSTACHIAN TUBE. A tube passing from the interior of the ear to the cavity of the mouth; the stoppage, by disease, is one cause of deafness.

EVAPORATION. The passage into vapour of fluids or solids. For its production, heat must be absorbed; hence the rapidity of evaporation is proportionate to the heat applied. Water and other fluids evaporating from the earth, or any surface, always produce cold by carrying away a part of the heat of the solid; *hence moist soils are cold.* The activity of evaporation is also influenced by winds, which will double the amount of water vaporized in a given time; hence winds dry rapidly and produce great cold. It is also necessary for free evaporation that the air be not already full of vapour. See *Dew Point.* When any atmosphere is surcharged with the vapour of a particular fluid, no more can evaporate; but the vapours of other fluids rise freely.

Plants are much affected by evaporation; their leaves are always throwing out large volumes of vapour of water, derived from the ascending sap; in this way their juices are thickened and fitted for nourishment. When the air is too dry, they languish under excessive evaporation; when it is moist and hot for some days, they become diseased, and smut, rust, and similar fungi attack them very destructively.

The moisture collected in the air by the evaporation of water from the earth, being cooled by northerly winds, becomes condensed into rain or snow, and falls back to the earth again. See *Clouds.*

EVERGREEN. Plants which put out a succession of fresh leaves instead of observing periods of rest. They are best set out in the fall or very early in spring.

EVERLASTING PEA. *Lathyrus*

latifolius. A perennial plant of the vetch kind, which grows naturally in some places; is easily cultivated, and annually yields a great burden of excellent provender, and might be cultivated to advantage as a green food for cattle on any of the more strong sorts of soil.

EXACERBATION. An increase of violence in the symptoms of fevers.

EXCORIATION. A bruise or abrasion of the skin: protection from air by a linen rag, and mild oil linaments are most serviceable.

EXCRESCENCE. Any unnatural growth or tumour.

EXCRETION. In physiology, the separation of useless or injurious portions of matter from the system, as urine, expired air, feces, perspiration. The excretions of plants have called forth much discussion. De Candolle imagined that the inability of plants to grow for a long time on the same spot was due to the deposite of excretions. Mr. Gyde has examined this matter thoroughly, and shown that the excretions are not injurious; the amount is very small, and identical in composition with the sap; he also found that a plant might be watered with a solution of its excrement with great benefit.

EXFOLIATION. The separation of diseased bone from that which is sound in the progress of a disease.

EXHALATION. Evaporation at ordinary temperatures, more especially from a living or solid surface.

EXHAUSTION. In physics, the removal of air or gases from the interior of bodies.

EXOGENOUS (from εξ, *outside*, and γεινομαι, *I grow*). A term applied to those plants a transverse slice of whose stem exhibits a central cellular substance or pith, an external cellular and fibrous ring or bark, and an intermediate woody mass, and certain fine lines radiating from the pith to the bark through the wood, and called medullary rays. They are called exogens, because they add to their wood by successive external additions, and are the same as what are otherwise called dicotyledons. They constitute one of the primary classes into which the vegetable world is divided, characterized by their leaves being reticulated; their stems having a distinct deposition of bark, wood, and pith; their embryo with two cotyledons; and by their flowers usually formed on a quinary type. Our forest-trees and most garden vegetables are of this kind.

EXORRHIZÆ (from εξ, and ῥιζα, *a root*). Exogenous or dicotyledonous plants, the roots of which extend directly from the embryo.

EXOSMOSE (from εξ, and ωσμος, *impulsion*). The passage outward of fluids, &c., the reverse of *Endosmose*, which see.

EXOSTOSIS (from εξ, and οστεον, *a bone*). A tumour on a bone. In botany, any knot or tumour on a trunk or large root: the wood is often finely curled.

EXOTICS. Foreign plants.

EXPANSION. The increase in dimensions produced by heat. In the arts, it is a serious drawback on perfect workmanship, for *beams*, *metallic tires*, &c., by the constant expansions from heat, and contraction by cold, are always acting upon masses of masonry injuriously. Gases expand most rapidly and extensively, fluids next, and metals least.

EXPECTORANTS. Medicines which assist in throwing off the phlegm of the throat, as ipecacuanha, tartar emetic, horehound, squills. They are useful in dry coughs.

EXPRESSED OILS. Such as are obtained by pressure, as olive, linseed, rape, castor, almond, as distinguished from volatile or essential oils.

EXTRACT. The solid remaining after boiling down an infusion or decoction to dryness. The heat used should be from steam. The term *extractive* is applied to that portion which is of a brown colour, soluble in water, and forms a colouring matter with alum solution.

EXTRAVASATION. In surgery, whenever blood or other fluids are thrown out from the veins into the skin, brain, or other parts, it is termed an extravasation. It frequently arises from a blow.

EXTRORSAL. Bent or turned from the direct position: a descriptive term in botany.

EXUVIÆ. The skins cast by snakes, lobsters, insects, &c., in the changes they pass through.

EYE, IN PLANTS. The bud, embryo, or growing point.

EYE OF THE HORSE. "The eye of the horse appears to be naturally more disposed to disease than that of any other animal. The diseases of the eye, although few in number, are frequent in their appearance, obstinate, and generally baffle all the skill of the veterinarian. The following are the principal: common inflammation, specific ophthalmia or moon blindness, cataract, and *gutta serena* or *amaurosis*. For the last there is no cure. Moon blindness, as it is termed, is brought on in a great measure by close confinement in dark, heated, and unwholesome stables. No specific remedies can be given for these diseases."—(*Youatt*). See *Blindness*, *Cataract*.

EYES IN CHEESE. Putrescent holes or places caused by imperfectly preparing the curd.

F.

FAGOT. A bundle of small wood.

FAGUS. The generic name of the *beech*.

FALCATE (from *falx, a scythe*). Shaped like a scythe: a descriptive term used in botany and zoology.

FALCO. The genus of hawks.

FALLOPIAN TUBE. A tube communicating between the womb and ovarium of the mammalia.

FALLOW. Originally, this term meant the exposure of the naked soil to rest, after ploughing several times, to destroy weeds and repair its fertility. This practice is now considered almost useless, as requiring much time and expenditure otherwise better employed. A crop of oats, clover, rye, buckwheat, lucern, lupins, turnips, or other cheap vegetable in flower is now ploughed in, and called a green fallow. In this way land is rapidly improved, especially if a liming is given. To turn in heavy herbage the ox-chain is fastened to the clevis and land-side handle of the plough, and this pressing down the plants, allows them to be buried.

Green fallowing is the most rapid and cheap method of bringing up poor lands; it incorporates into the soil the nitrogen bodies wanted for high cultivation, enables the improver to proceed without the expense of cattle for raising manure, and saves the time necessary to wait for the manure. The herbage so turned in yields more vegetable mould than it would otherwise form if applied in any other way. Fallows can be made at any time, in summer for a fall crop, or in autumn for spring.

FAN, WHEAT. The *Winnowing Machine*, which see.

FARCY. See *Horse*.

FARDING BAG. The paunch or *abomasus* of the ox.

FARINA. The flour or meal of grain. *Farinaceous* is a derivative.

FARM. "The first thing to be considered in taking a farm is the capital which the tenant is possessed of, or of which he can procure the use at a reasonable rate. If a man takes a farm without the means of stocking it properly, and is restrained in his first outlay, he will never be able to cultivate it with benefit to himself: he will be obliged to sell his produce at a loss, to over-work his cattle, and to keep a smaller quantity of stock, and, consequently, make less manure than is required to keep the farm in a productive state.

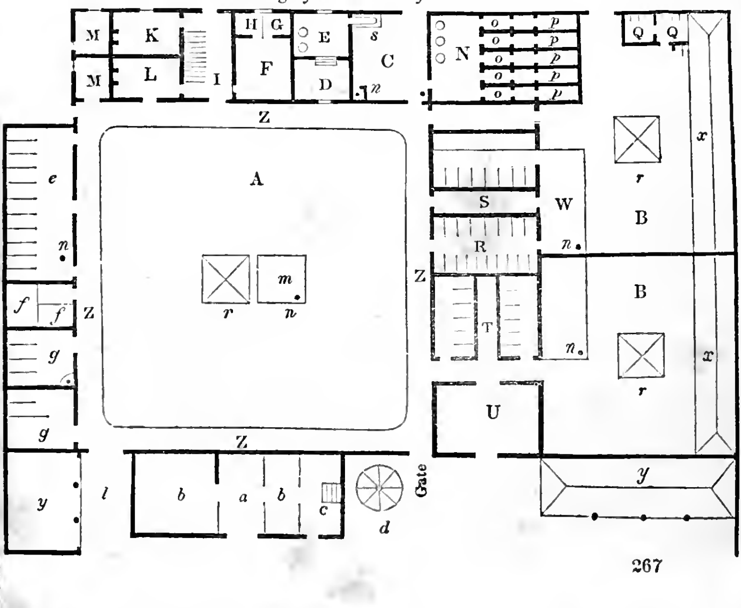
"When it is ascertained what extent of farm may be safely undertaken with a given capital, the most important object to be attended to is the condition and fertility of the soil, not only with respect to the natural quality of the land, but the actual state it is left in by the preceding system of cultivation. A moderately fertile soil, in good condition, will give a greater profit for several years than a better soil which is partially exhausted and rendered foul by injudicious management and over-cropping. For this purpose, it is necessary to ascertain what has been the state of the crops for several years before, how the land has been ploughed, and whether the crops have been heavy with or without manure. In the mean time, the nature of the weeds which abound on the land will give some clew to its state; and an experienced person will collect from various minute appearances in the soil whether it has been fairly managed or exhausted. It is in general more advantageous to take a farm in a district with which you are well acquainted. It will be a great advantage if you have had an opportunity of seeing the land at all times, observing it in different seasons and states of the weather, and especially of seeing the crops thrashed out, and ascertaining the quantity of corn which is usually yielded from a certain quantity of straw, for lands very similar in outward appearance will produce a very different return when the crops are thrashed out. A want of attention to these circumstances is the cause that a man who comes from a distant part of the country and takes a farm on his own judgment seldom succeeds so well as might be expected, even with a superior knowledge of agriculture. He naturally compares the soil with some similar soil which he has been acquainted with. If he comes from a district where the soil is sandy, and where clay is in request, he will give the preference to very stiff loams; if he comes from a cold wet clay, he will prefer the sandy; and the chances are, that he is mistaken in his judgment, and finds it out when he has already embarked his capital in a losing concern. Next to the nature of the soil is to be considered the convenient situation of the farm, the disposition of the fields, and the adaptation of the farm-buildings to the most profitable occupation of the land. The roads, especially those which lead to neighbouring towns, whence manure may be obtained, are a most important object; and if there is water-carriage, it greatly enhances the value of the farm. The roads to the fields, and the distance of these from the farm-yard; the convenience of having good pasture, or land easily laid down to grass, near the homestead, and especially the situation of the farm-buildings with respect to the land, and the abundance of good water, are all circumstances which must be well considered, and which will greatly influence the probable profits, and, consequently, the rent which may be fairly offered. A central situation is no doubt the most advantageous for the farm buildings, as greatly diminishing the labour in harvest and in carrying out manure. But there may be circumstances which render some spot nearer the extremity of the land more eligible, and it is only when entirely new buildings are to be erected that there is a choice. The old farm buildings are generally in low and sheltered situations, but it is a great inconvenience to have to carry the manure, which is the heaviest thing carted on a farm, up a steep hill. The best situation is on a moderate slope, neither in the lowest nor highest ground.

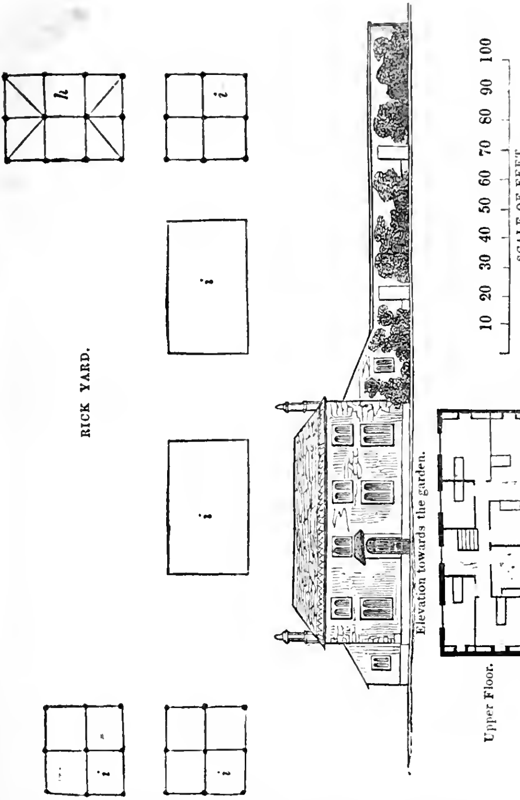
"The yard or yards in a large farm should be sheltered on the north side by the barns, which need not be so extensive as used formerly to be thought necessary. If there is a thrashing machine, a single floor to thrash the seeds upon, and to employ the men occasionally in winter, is quite sufficient. Every farm which is so extensive as to require more than one floor to thrash the corn on ought always to have a thrashing-mill attached to it. See *Barn.*

"A small yard, distinct from the other, with sheds for the cattle to shelter themselves under in wet and stormy weather, is a great advantage, and may be added at a trifling expense to any set of farm buildings. The cart-shed should be in the stack-yard, which properly occupies a space north of the barn. There should be a sufficient number of stands with proper pillars and frames to build stacks on. Each stack should be of such a size as to be conveniently taken into the barn to be thrashed out. The round form, and the square, which becomes nearly round when built up, are most convenient. Nine stone or cast-iron pillars, with caps over them, are placed on brick foundations, and support a strong frame on which the stack is built. In the centre of the stack there is usually a pyramidical open frame, to allow the air to circulate through the stack and prevent the heating of the grain. On each side of the yard should be placed the stables, cow-houses, and feeding-stalls, with a pump of good water near the last, and convenient places to put hay, straw, and turnips in, with a machine to cut them. A great deal of time and labour is saved by a proper arrangement of the different parts of the farm buildings. An under-ground cistern near the cow-house and stables, into which the urine and washings of the cow-house may run by means of a sink or drain, is a most useful appendage, which is too little thought of in England, whereas it is one of the most indispensable parts of a Flemish farm. It supplies a kind of manure which can be applied to the land at all times, which invigorates sickly crops, and may often produce an abundant return, where otherwise there would be a complete failure. There are many plans of farm buildings given in works on agriculture, which combine all that is useful on a large scale. Most of these plans have been executed at a great expense for the farming establishments of men of large fortunes. But the proprietor who desires to erect buildings most proper for the occupation of his land must study economy, and lay out no more in buildings than is necessary. They should be so substantial as not to require frequent repairs, without unnecessarily increasing the original expense of materials and labour. Light thatched roofs are sufficient for the sheds and smaller buildings, and even for the cow-houses and stables.

"We here give a plan of plain farm

Buildings for a Farm of 300 *acres.*





A, principal yard; B, second feeding-yard, divided; C, small paved yard adjoining the dairy and piggery; D, dairy, two feet under the level of the yard; E, wash-house; F, kitchen; G, skullery; H, larder; I, entrance and stairs: K, best parlour; L, second ditto, cellars under them; M M, coal and wood house; N, steaming-house for pigs; Q Q, hen-houses; R, calf-pens; S, cow-house for sixteen cows, with a passage through it; T, bullock-house; U, root and straw house to cut turnips, chaff, &c.; W, cistern, divided into two by a partition, sunk seven feet and vaulted over; Z, paved road round the yard; *a*, barn floor; *b b*, bays; *c*, raised floor and thrashing-mill; *d*, horse-race; *e*, horse-stable; *f f*, loose boxes; *g g*, spare stables and chaise-house; *h*, granary on stone piles; *i i i*, corn stacks; *l*, entrance to the yard; *m*, tank covered over; *n n n*, pumps; *o o o*, pig-sties; *p p p*, small open court to each sty; *r r*, feeding-cribs; *s*, oven; *x x*, open sheds for cattle; *y*, cart-sheds.

buildings for the occupation of 200 or 300 acres of land, of which two thirds are arable, fit for corn, barley, clover, and wheat. There should be two distinct farm-yards with proper sheds, and in each there should be a cistern for the urine from the stables and the drainings from the dung.

"These two examples of farm buildings will be sufficient to give some idea of what may be proper for farms of an intermediate size. A principal thing to be attended to is to have plenty of room for cattle; and where old barns remain much larger than is required, according to the present mode of stacking corn in the yard, they can be very advantageously converted into cow-stalls or ox-stables.

"Where many sheep are kept, it is of great advantage to have a sheep-yard, with low sheds all round, at the time when the ewes lamb, especially when the season is wet and chilly, which hurts them more than a dry frost. The second yard, B, is well adapted for that purpose, and an additional temporary shed against the partition which divides it into two will convert either division into an excellent sheep-yard.

"In valuing a farm, the habitation is seldom taken into the account, but

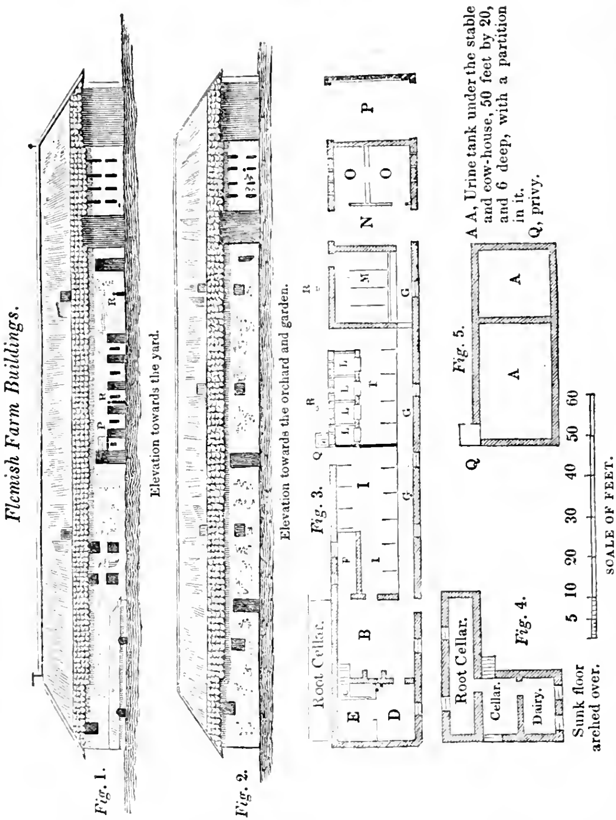


Fig. 1. P, privy; R R, pumps for urine. *Fig.* 3. B, kitchen; D and E are sleeping-rooms raised a few feet above the kitchen, and over the dairy and cellar; F, a workshop for weaving and other work; G, passage to feed the cattle; I I, cow-house; L L, pig-sties; M, stable; N, barn floor; O O, bays; P, cart-shed; Q, privy; R R, pumps for urine.

the buildings immediately connected with the cultivation necessarily add to or diminish the price.

"*Farm Accounts.*—In proportion as the management of a farm requires more skill, and the various operations become more complicated, so the necessity of great accuracy in the accounts becomes more evident. The manner in which farm accounts should be kept deserves, therefore, particular attention.

"Many farmers, who are not devoid of intelligence, and who are anxious to ascertain their gain or their loss in cultivating the land which they have hired, have no other means of ascertaining this than the balance of their account of receipts and expenditure. If they have separated the accounts of their private establishment from that of their farm, they think that they have done all that is required, and at the end of the year they can tell accurately how much they have gained or lost by their farm; but ask them to account for this gain or loss, and they can give no answer. If a tradesman, who has a capital in business equal to that of a farmer of a considerable number of acres, were to keep accounts in this manner, and become a bankrupt, no one would hesitate in saying that he failed because he kept no regular accounts. He had no greater stake than the farmer, and his transactions were perhaps less varied: if he kept no clerk, he should have attended better to the accounts himself. The same may be said of the farmer; and if a man who has a floating capital of $10,000 does not think it worth his while to employ a clerk to keep his accounts, not having time to do so himself, it is no great wonder if he is involved in difficulties. But it may be said that agricultural accounts are very simple, and that any one can keep them. So are merchants' accounts at first sight. Nothing is simpler than to put down what is bought and sold, what is the profit on each transaction, and the sum is the profit of the whole; but merchants know that to keep this very simple account many books, many entries, many checks, and consequently many clerks are required. In a lesser degree this is true in a farm. It is easy to know what is bought and sold, what is expended or produced, but it requires very minute accounts to ascertain what part of the farm gives a profitable return, and what is the cause of loss. There may be a profit on the crops and a loss on the stock, or *vice versâ*. The money expended on improvements or adventitious manure may have produced an increase which is proportionate to the outlay, and which affords a good interest; but it may also be a decided loss. How is this to be ascertained, except it be by accurate accounts? In whatever manner the accounts are kept, whether by the farmer himself or by a clerk, method is of great importance; and whatever may be said against it by those who do not know its value, there is no system of accounts which can be compared with the well-known method of double entry. The principle of this method is so simple that the slowest arithmetician cannot be confused by it, and it is so perfect that no error can escape its scrutiny. As applied to agricultural accounts, which are simple in their nature, it becomes so clear that, if once adopted, it is impossible that it should ever be abandoned. The satisfaction of a perfect proof of the correctness of the accounts is so great that no one who has ever experienced it will be satisfied with any other method.

"In the accounts of a farm there are many separate items to be taken into consideration. There may be a separate account kept for every field; there should always be one for every crop of which the rotation consists. There is an account of the labour of men and horses; of the produce of the dairy; of the stock purchased to be fattened, or sold again in an improved state. The more subjects there are to furnish items for an account, the more difficult it is to strike a balance, but with a little attention and perseverance it may be done; and he who keeps very correct accounts will always be the first to discover any impending evil, and to take measures to provide against it.

"The basis of all the accounts is a daily journal of every transaction, which must be collected from all the labourers and agents employed. M. de Dombasle, at his celebrated farm of Roville, in France, has all his principal men and apprentices assembled every evening after the day's work is over. Each man gives an account of the work done by him or under his superintendence, which is written down by the clerk. The orders for the next day are then given, and every one returns to his lodging or his home. In the course of the next day the clerk enters all that is in the journal into a book, where every person employed has an account: every field has one; every servant and domestic animal has one; and every item which can be separated from the rest is entered, both as adding to the account or taking from it. For example, the milk of the cows is entered daily; the quantity of butter, butter-milk, and skimmed milk which it produces is also entered; and these two accounts check one another. Any error is immediately detected, and the knowledge of this prevents mistakes. An entry should be made of every particular operation in each field, that the farmer may know which is his most profitable land. The number of ploughings, the quantity of manure, the state of the weather, and all other circumstances which may influence the return should be carefully noted, in order that it may be clearly seen whether any experiment or deviation from the usual routine is advantageous or otherwise. Thus all real improvements may be encouraged, and uncertain theories detected by the result.

"The most important circumstance which influences the profits of a farmer is the cost of his team and the wages of his men. These vary in different situations so much that they greatly influence the price which he can afford to give for the land. In some parts of the country the horses are pampered and kept so fat that they can scarcely do a day's work as they ought; in others they are overworked and badly fed. Either extreme must be a loss to the farmer. In the first case, the horses cannot do their work, and they consume an unnecessary quantity of provender; in the other, they are soon worn out, and the loss in horses that become useless or die is greater than the saving in their food or the extra work done by them. A horse properly fed will work eight or ten hours every day in the week, resting only on Sundays; by a judicious division of the labour of the horses, they are never over-worked, and an average value of a day's work is easily ascertained. This, in a well regulated farm, will be found much less than the common valuations give it. There have been printed forms invented, in order to render the accounts more simple, as well as more comprehensive. Forms may be of use to enter minute details; and each superintendent may have a form of entry for the work which he performs or superintends; but the ledger should be kept exactly as that of a mercantile man, and be frequently balanced to ensure correctness. This is a thing which cannot be too strongly recommended to young farmers."

FARM-YARD MANURE. The excrements of cattle mixed with vegetable litter accumulated in the farmyard. Straw, peat, sea-weed, the haulms of crops, leaves, and any organic matter may be added to swell the bulk. It is usual to make the yard somewhat inclined, so that the fluid portions may run into a tank at the bottom. The reservoir should be tight, either of cement or tempered clay; it may be furnished with pumps, to return the fluid over the solid matters several times during its preparation. The dung should be piled in ridges of five feet high and as many wide, and kept trodden together; it should not be permitted to heat too much or be kept too wet. It is very much improved by an addition of charcoal, gypsum, and lime, applied occasionally to the layers as they are brought out from the houses. In well-tilled soils twenty to thirty cart-loads the acre are applied for a rotation of three or four years. Corn, wheat, potatoes, or tobacco usually receive the manure. Sandy soils require less manure, but more frequently repeated.

Farm-yard manure wastes rapidly by exposure and the action of rain, its soluble salts being removed, and the volatile ammoniacal portions rising into the air. Great benefit would be found from the erection of slab or thatched sheds for the protection of the heaps.

It is of service to all crops, because, being made up of the offal of vegetables and food, it contains all the necessary salts and organic matters; but, in the usual way of preparation, it is also the depository of the seeds of weeds and insects, and tends to render the husbandry foul. By preparing with lime, and managing it in the dry way, eremacausis is produced, which destroys the seeds and eggs, at the same time that it diminishes the waste by volatilization.

The value of the manure is dependant upon the food used, and the proportion of dung to straw, the litter absorbing the fluid parts and running into decay, but reducing the value of any given weight of the manure. Where animal garbage or fish can be obtained, the value is much increased. (See *Manures*.) But in the common yard dung the fluid parts are altogether the richest portions.

Yard manure should be taken out and ploughed as early in the spring as possible, before it is much reduced by rotting, nor should it be in the soil very long before the seeds, for it wastes away rapidly. Well-rotted dung is necessary for particular plants, but is by no means economical. In many cases an application to the hill is best, as in potatoes, turnips, corn, and tobacco.

Soiling is a certain means of increasing the quantity of manure at the same time that expenses are lessened; it is to be considered an essential in good arable husbandry. It is common to keep the horse, cow, and pig dung separate; but there is little benefit in this.

Composition of Farm-yard Manure. —"The elementary composition of farm dung is a point which is not undeserving of consideration," says Boussingault. "The animals which had produced the dung were thirty horses, thirty oxen, and from ten to twenty hogs. The absolute quantity of moisture was ascertained by first drying in the air a considerable weight of dung, and, after pounding, continuing and completing the drying, in vacuo, at 230° Fahrenheit.

"The dung prepared in the winter of the year

1837–8 contained	20·4	per cent. of dry matter.
1838–9 "	22·2	
In summer of 1839	19·6	
Medium	20·7	
Water	79·3	

"Analysis yielded the following results:

Times of preparation.	Carb.	Hyd.	Oxyg.	Azote.	Ashes.
Winter of 1837–8	32·4	3·8	25·8	1·7	36·3
"	32·5	4·1	26·0	1·7	35·7
"	38·7	4·5	28·7	1·7	26·4
Spring of 1838	36·4	4·0	19·1	2·4	38·1
" 1839	40·0	4·3	27·6	2·4	25·7
" "	34·5	4·3	27·6	2·0	31·5

"On the average, farm dung, dried at 238°, contains:

Carbon	35·8
Hydrogen	4·2
Oxygen	25.8
Azote	2·0
Salts and earths	32·2
	100·0

"When moist, its composition is represented by

Carbon	7·41
Hydrogen	0·87
Oxygen	5·34
Azote	0·41
Salts and earths	6·67
Water	79·30
	100·0

"The constitution of dung heaps must of necessity vary; those, however, which have a common origin do not seem to present very great differences in the proportion of their elements.

"*Excretions of the Horse.* — The horse was fed upon hay and oats. The urine and the excrements together contained 76·2 per cent. of moisture. In twenty-four hours the excretions weighed, moist, 34·2 pounds; dry, 8·1 pounds.

"Their composition was found to be:

	In the dry state.	Moist ditto.
Carbon	38·6	9·19
Hydrogen	5·0	1·20
Oxygen	36·4	8·66
Azote	2·7	4·13
Salts and earth	17·3	4·13
Water	17·3	76·17
	100·0	100·0

"*Excretions of the Cow.*—The cow was fed upon hay and raw potatoes. The urine and the excrements together contained 86·4 of moisture. The weight of the excretions, in twenty-four hours, was, moist, 80·5 pounds; dry, 10·9 pounds.

"Their composition, by analysis, was:

	Dry.	Wet.
Carbon	39·8	5·39
Hydrogen	4·7	0·64
Oxygen	35·5	4·81
Azote	2·6	0·36
Salts and earth	17·4	2·36
Water	17·4	86·44
	100·0	100 00

"*Excretions of the Pig.*—The pigs upon which the observations were made were from six to eight months old. They were fed upon steamed potatoes. The urine and the excrements lost, by drying, 82 per cent. of moisture. The average of the excretions yielded by one pig in twenty-four hours was, moist, 9·1 pounds; dry, 1·6 pounds.

"Composition:

	Dry.	Moist.
Carbon	38·7	6·97
Hydrogen	4·8	0·86
Oxygen	32·5	5·85
Azote	3·4	0·61
Salts and earth	20·6	87·01
Water	20·6	82·00
	100·0	100·00

"The litter that is generally employed is wheat straw. This straw, in the condition in which it is used, contains 26 per cent. of moisture.

"Its composition is:

	Dried.	Undried.
Carbon	48·4	35·8
Hydrogen	5·3	3·9
Oxygen	38·9	28·8
Azote	0·4	00·3
Salts and earth	7·0	5·2
Water	7·0	26·0
	100·0	100·0

"At Bechelbronn each horse receives daily, as litter, 4·4 pounds; each cow, 6·6 pounds; each pig, 4·1 pounds of straw.

"To the stables and the cow-houses together are given, every twenty-four hours, 132·0 pounds of straw for thirty horses; 198·0 pounds for thirty horned cattle; 66·0 pounds for sixteen pigs; making 396·0 pounds of straw, estimated, when dry, at 292·6 pounds.

"The composition of the materials which constitute the dung produced in one day are set forth in the following table:

Excretions yielded in 24 hours by	Weight when dry.	Weight in the wet state.	Elements of the dry matter.					Water constituting the wet matter.
			Carb.	Hydrog.	Oxygen	Azote.	Salts & earths.	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Thirty horses	245·08	1028·28	94·60	12·32	89·10	6·60	42·46	783·20
Thirty horned cattle	326·36	2416·48	130·24	15·40	116·16	8·58	56·98	2089·12
Sixteen pigs	26·40	146·74	10·12	1·32	8·58	0·88	5·50	120·34
Straw used in litter	292·60	396·00	41·68	15·62	113·74	1·10	20·46	103·40

"The average or mean composition of this mixture may be taken as follows:

In the dry state.					In the wet state.					
Carbon.	Hydrog.	Oxygen.	Azote.	Salts.	Carbon.	Hydrog.	Oxygen.	Azote.	Salts.	Water.
42·3	5·0	36.7	1·9	14·1	9·4	1·2	8·2	0·4	3·2	77·6
That of the resulting Dung.										
35·8	4·2	25·8	2·0	32·2	7·4	0·9	5·3	0·4	6·7	79·3

"On comparing the composition of the dung-heap with that of the different kinds of litter collected in a day, little difference is observed; the larger quantity of saline and earthy matters discovered in the fermented manure is readily explained from the additions of ashes incorporated with it, and also by the accidental admixture of earthy matters proceeding from the sweepings of the court, the earth adhering to the roots consumed as food, &c.—refuse of every kind, the residue after cleansing the various kinds of fodder for the stable and stall, &c., all go to the dung-heap. Lastly, and with reference to the elements that are liable to be dissipated in the state of gas, or which may be changed into water, the azote is precipitated in larger quantity in the prepared manure than in the unfermented litter and excretions. This is at once seen on comparing the composition of these two products after the saline and earthy matters have been deducted.

	Carb.	Hydrog.	Oxyg.	Azote.
The composition of fresh litter is	49·3	5·8	42·7	2
That of dung	52·8	6·1	33·1	3.0

"Dung is, therefore, somewhat richer in carbon than litter, and it contains less oxygen.

"Fermented dung contains less oxygen than that which comes from the stable; it ought also to contain less hydrogen; but this analysis does not proclaim.

"Azote is, in fact, the element which it is of highest importance to augment and to preserve in dung. The organic substances which are the most advantageous in producing manures are precisely those which give origin, by their decomposition, to the largest proportion of azotized matters, soluble or volatile. I say by their decomposition, because the mere presence of azote in matters of organic origin does not suffice to constitute them manure. While we admit the high importance, indeed the absolute necessity of azotic principles in manures, then, we must not therefore conclude that these principles are the only ones which contribute to fertilize the earth.

"It is unquestionable that the alkaline and earthy salts are farther indispensable to the accomplishment of the phenomena of vegetation; and it is far from being sufficiently shown that the organic principles void of azote play a merely passive part when added to the soil. But with few exceptions, the fixed salts, water or its elements, and carbon, superabound in manure. The chemical nature of the salts is the same as that of the fodders used. The element which exists there in smallest proportion is azote, which is the one, also, that is most apt to be dissipated during the alteration of the bodies that contain it. For these reasons, azote is really the element whose presence it is of highest moment to ascertain; its proportion is that, in fact, which fixes the comparative value of different manures.

"Since it is by undergoing modification in the course of their decomposition by putrefaction that those azotized substances which are favourable to vegetation are developed in quaternary compounds, it will be readily understood that, all things else being equal, a manure which is completely resolved into soluble or gaseous products in the course of a single season will exert, in virtue of this alone, the whole of its useful influence upon the first crop. It is entirely different if the manure decomposes more slowly; its action upon the first crop will be less obvious, but its influence will continue longer. There are manures which act, it may be said, at the moment they are put into the ground; there are others, the action of which continues during several years. Nevertheless, two manures, although acting within periods so different in point of extent, will produce the same final result if they severally contain the same dose of azotic elements, if they are of the same intrinsic value.

"The durability of manures, the length of time during which they will continue to exert their influence, is a matter of great importance. It often depends on their state of cohesion, or on their insolubility, though climate and the nature of the soil have also a marked influence on their decomposition and consequent effects. It is not easy, in the present state of knowledge, to predict with certainty how long the beneficial effects of a given manure will continue to be felt; but we know well enough what will hasten the decomposition of manure and what will retard this result, and so apportion, as it were, the fertilizing principles among the different crops in the rotation."

In Switzerland it is common to apply a small quantity of the solution of green vitriol or copperas (sulphate of iron) to the yard manure. One pound of copperas in solution will answer for about three hundred weight of the manure. This converts the carbonate into sulphate of ammonia, and removes any bad odour. It also improves the quality of the manure very considerably.

FARRIER. One who shoes horses, or treats their diseases; the latter department is now coming into the hands of educated men, called veterinary surgeons.

FARROW. A litter of pigs.

FASCID. In anatomy, a tendinous expansion lying between muscles.

FASCICULUS, or FASCICLE. In botany, an inflorescence in which the flower-stalks of various lengths form a summit somewhat level, and the uppermost buds expand first, as in the sweet William.

FAT. A solid oil, which combines with soda and forms soap. In the body it is stored in cells, in membranes existing under the skin, over the intestines and kidneys. The varieties in consistence of different fats depends upon the proportion of the stearin and elain they contain; the former being the solid part, the latter the fluid or oily. They are insoluble in water, partly soluble in alcohol, and partly in ether.

Fats answer, in animals, several important functions. They serve to maintain the warmth, by excluding atmospheric cold; lubricate joints and the spaces between muscles, and afford the means of sustaining animal heat by their consumption in the body during severe weather. In well-fattened animals it is deposited even between the fibres of the muscles.

Chemically, they are hydro-carbons, and consist of oily acids combined with glycerine. Stearin consists of carbon, 79; hydrogen, 11·7; and oxygen, 9·3 per cent., and gives us a fair representation of the composition of the rest. The fats of vegetables are identical with those of animals, excepting where a peculiar odorous body is added, as in goat fat, whale oil, &c. For the various ingredients of fats, see *Elain*, *Stearin*, *Magarine*, *Olein*, *Butter*, &c.

The purification of fats for the manufacture of soaps and candles is effected by first mincing it in fine pieces, melting in warm water, and straining through a sieve. It may be farther purified by remelting in water acidulated with 2 per cent. of sulphuric acid, stirring it constantly, allowing it to cool, and skimming off the tallow, which should be afterward remelted with an abundance of fresh water. In this way it becomes very white and hard.

The rancidity of fats and oils is due to the absorption of oxygen from the air and the production of new pungent bodies, termed hircic, capric, &c., acids. This is also the reason why butter spoils unless well worked before storage to remove all the air contained in it.

FATTENING ANIMALS. The accumulation of fat is unquestionably dependant upon the food in part, but it also depends upon the disposition and management of the animal. A docile breed, as the Durham ox or China hog, is more easily fattened than one that is restless. A disposition to rest and sleep is very necessary, and is encouraged by placing the animals in darkened stalls, allowing them to be seldom troubled, and supplying rich food often during the day. As the fat accumulates, the skin feels very silky and the animal becomes lethargic; in this state it should be slaughtered, for otherwise they become liable to sudden death. Great attention is necessary to the cleanliness of the animal, the skin of which should be curried and washed to prevent disease. The food is gradually increased in nutritiousness and amount of oil it contains, until the fattening is perfect. It is seldom that the accumulation of weight exceeds two to two and a half pounds the day, notwithstanding the ration is doubled, or three and a half to four per cent. of the weight of the animal given in hay, or its equivalent. Small beasts are fattened more economically than large ones, and unless the skin handles well, or is soft and elastic to the touch, the prospects for rapid fattening are not good. The length of time necessary to finish the fattening is four or five months in oxen, but is less during warm than cold weather.

FATTENING FOOD. The experience of farmers has always been in favour of the doctrine that oily provender is required to produce fat; beech-nuts, linseed-oil cakes, and corn enjoy the highest reputation, and are most charged with oil. Liebig has, however, advanced the doctrine that farinaceous vegetables, as the potato, carrot, &c., are fattening from the starch they contain; but although this may be true physiologically, yet in ordinary farm management it is found cheaper and more expeditious to use fodders already containing the fat, rather than to wait for the slower transformation out of starch.

Fattening food should be well prepared by grinding, and steaming for hogs. A mush that had become slightly sour was found to fatten more expeditiously by Arthur Young than the fresh food. The following table gives the comparative values of provenders for fattening, by showing the amount of oil they contain:

Indian corn . .	9	to	10	per cent.	of oil.
Oats	4	to	5	"	"
Wheat . . .	2¼	to	2½	"	"
Bran	4	to	5	"	"
Oil cake . . .	9	to	10	"	"
Clover hay . .	4			"	"
Meadow hay . .	3½	to	4	"	"
Pease and beans .	2½	to	3	"	"
Beech mast . .	15	to	17	"	"
Sunflower seed .	15			"	"
Linseed . . .	11	to	22	"	"
Hemp seed . .	18	to	25	"	"
Straw	1	to	1½	"	"

These numbers are not constant, for the amount of oil depends upon the season, increasing with the brilliancy and dryness of the weather. Potatoes, beets, carrots, turnips, mangel wurzel, contain less than one quarter per cent., and are therefore not adapted for fattening alone.

The same values are true for butter and milk, except that oil cake imparts a bad flavour. Poultry and pigs are now sometimes fattened in part on animal fat, as cracklings, greaves, &c. One of the most successful bodies in the list is ground linseed meal, but, considering its other qualities, corn is the most esteemed. If the cake or oily seeds are used, it will be necessary to mix meal, oats, or pease with them, to preserve the health of the animal; five pounds of cake are a sufficient supply for the day.

FATHOM. A measure of six feet.

FAUCES. The part of the throat at the root of the tongue.

FAULT. In geology, an interruption in the continuation of a stratum, the bed having been broken by an earthquake and separated. The crevice between the parts is often filled with clay, which forms an impervious barrier to drainage.

FAUNA. The animals of a country.

FAUX. The opening or throat of monopetalous flowers, like the snapdragon, sage, &c.

FAVOSUS (from *favus, a honeycomb*). Marked like a honey-comb.

FEATHER-BOARDING. Weather-boarding, the edges of the boards overlapping.

FEATHER-GRASS. *Stipa pennata.* A very inferior grass.

FEATHERS. The covering of birds, answering the purpose and being of the same composition as the hair and fur of animals. Goose-feathers for beds are, in Europe, plucked in the spring, midsummer, and September, each parcel being dried in an oven. If they become foul, it may be remedied by boiling them, enclosed in bags, in an abundance of water for a few minutes. The quill is prepared by dipping in a quantity of sand heated to 150° Fahrenheit, and afterward rubbing it strongly with flannel until it becomes clear.

Waste feathers, as a manure, are precisely of the same value as *woollen rags*, which see.

FEBRIFUGE. Any medicine which allays the heat and violence of fevers, as lemonade, Seidlitz powders, tartar emetic, &c.

FECES. Excrements, dregs.

FECULA. Starchy matter.

FECUNDATION. In horticulture, the act of sprinkling the yellow powder (*pollen*) of the stamens of one flower upon the stigma or female organ of another, to produce new varieties of seed, is called *artificial* fecundation or impregnation. The late Mr. Andrew Knight obtained in this way many choice fruits. Varieties of plants, especially melons, are frequently injured and lost by planting them near each other, from fecundation arising from the pollen of one kind being carried to another by insects or the wind. Hence annuals of the same species set out for seed should be placed far apart.

FEED. The quantity of provender or ration allowed a horse, cow, &c. Growing animals require three per cent.; working horses, two;

milch cows, three; and fattening animals three and a half to four per cent. of their weight in hay or its equivalent. See *Fodder*.

FEELERS. The antennæ of insects, or, according to entomologists, organs fixed to the mouth, used for prehension.

FELINE ANIMALS. Beasts of the tiger, lion, and cat race. They are carnivorous, furnished with sharp incisor teeth, and retractile claws.

FELL. The hide of an animal.

FELLING TIMBER. Much discussion has arisen as to the time of felling timber, some contending for winter, others for summer. Duhamel, who examined the matter thoroughly, came to the conclusion that the time of cutting was of little or no importance on the durability of the timber. The rule now established is, that soft woods, as the elm, poplar, maple, willows, are best cut in winter, the harder trees in summer, and old trees may be cut at any time.

FELLINIC ACID. One of the acids found in bile by Berzelius.

FELLMONGER'S POAKE, or CLIPPINGS. The clippings of skins and the scrapings of leather. It contains hair, skin, and lime, and is best introduced into composts to increase the amount of nitrogen. A direct application is wasteful, for it decays rapidly.

FELLOES. The curved pieces of wood which form the circumference of wheels: ash is preferred for this purpose.

FELON, or FETLOW. In farriery, a term for a sort of inflammation in animals similar to that of whitlow in the human subject.

FELDSPAR. A common mineral abounding in granite and transition rocks; it is crystalline, of a pearly lustre, and of various colours, usually of a yellowish or reddish aspect. It is a silicate of potash and alumina, containing from eleven to fourteen per cent. of real potash, and furnishing, by slow decay in the soil, that important alkali to plants. Albite is a variety containing soda. An abundance of decaying vegetable matter in the soil, or the addition of heavy dressings of lime, assists the disengagement of the potash, and thus advances fertility. No soil which contains much feldspathic sand can be deficient in potash.

FEMUR. The thigh bone; hence *Femoral*.

FEN. A boggy or marshy place. See *Bog*.

FENCES. Erections to protect land from the trespass of cattle. They are called live fences, or hedges, when made of shrubs. See *Hedges*.

Wood, being so common, is usually employed in the United States; but *walls* of blasted rock or loose stones are frequently seen. Stumps form an admirable fencing material. Banks of earth, dug from a ditch and covered with sods, or a ditch only, are also used; in the prairies they would, perhaps, be cheaper than rail fencing. These structures are, however, very expensive, and should be diminished by the introduction of the system of soiling.

Wooden fences are commonly erected in the zigzag direction; the cross fence, consisting of one piece set slanting upon two others stuck into the ground, and made to cross near the top, is much less permanent. The post and rail is very superior, but more expensive, but, by using preserved timber, might be made imperishable. See *Preservation of Timber*. Railings are readily rived from straight pine, but look much neater when sawn. In Virginia the law requires a fence of ten rails, with riders, which is unnecessarily high; five rails, with riders, being used in Jersey. The rails are cut twelve feet long. A rod costs from 50 to 70 cents.

Hurdles, or light moveable fences, consisting of panels, about four feet long and four feet and a half high, are much used in Europe to confine sheep, each panel being furnished with two end pieces long enough to be stuck fast into the earth. They are tied together, when set up, with withes. Sometimes they are made of osier, but usually of any small wood. By means of them, turnips spring rye, &c., can be depastured. A light post and rail fence may be made moveable by furnishing the posts with feet. Light iron and wire hurdles are now introduced in England, and also iron rods passed through wooden posts for permanent fences.

Walls are put up at fifty cents to one dollar the rod. The following is from Law:

"The stone wall may either be formed of stones built without cement, or it may be built with mortar like common masonry; but the last of these methods is rarely practised with the common fences of a farm. The cementing of the stones with mortar adds, indeed, to the durability of the wall, but then the expense is too great in common cases. The wall, therefore, for the ordinary purposes of the farm, may generally be built of stones alone, though sometimes with a little mortar, merely for cementing the coping, and occasionally for pinning or closing the interstices of the outside. When stones cannot be obtained, brick may be substituted.

"The materials for building the dry stone wall, as this kind of wall is termed, may be sandstone, whinstone, or any other stones of sufficient durability. Loose stones taken from the surface, termed land stones, answer sufficiently well, if they be of proper size, and not too much rounded; but in the latter case they present too smooth a surface, and cannot be kept in their places without mortar.

"The implements to be used in building the dry stone wall are a mason's hammer, a spade or shovel for clearing the ground for a foundation, a pick or mattock, and a frame of two upright posts fixed together, so as to correspond with a vertical section of a portion of the wall.

"The line of the intended fence being fixed upon and marked on the ground, the stones for building should be brought forward, and laid down on both sides, if possible, of the line of fence, but if not, on one side.

"Pins being fixed in the centre of the space to be occupied by the wall, the workman proceeds thus: he carries his wooden frame to some distance along the line to be built upon; he sets it perpendicular, which he is enabled to do by means of a plumbline attached to it. He then fixes another similar frame at the place where the wall is to commence; he stretches two cords between these two frames on the outside, and as these cords correspond with the outside of the wall at a given height, he has a guide for building it of the required dimensions. After having built one portion, he uses only one frame, the wall itself serving afterward the part of a frame; for the cords being fixed to both sides of the wall, and then attached to the frame which is placed in advance, the workman has, as before, a guide by which he proceeds in building.

"The foundation of the wall should be laid on firm ground, and when there is not green sward to build upon, the loose earth should be taken out by the spade, until a solid foundation is arrived at. In building, the largest and flattest stones should be used for the foundation; and it is very desirable, if the materials used will allow, to place stones at intervals of sufficient size to lie across the breadth of the wall, so as to bind the wall together, and render it more secure.

"Different kinds of coping may be placed upon the wall to defend it. One of these consists merely of turf, two sods being laid upon the wall, with the earthy sides placed towards each other. Another species of coping consists of large stones, which, being closely built and wedged together, are cemented by mortar. This is a complete and durable species of coping; but when it is used, a row of flat stones should be laid on the top of the wall immediately beneath the coping, and made to project a little on each side of it.

"A wall, sufficient for the purposes of the farm, may be 32 inches wide at bottom, 16 inches wide at top, and, including the coping, 4½ feet high. Two good cart-loads of stones will suffice for building a yard.

"When a fence is required within sight of a dwelling, and it is desirable for it to be concealed, a deep ditch is sometimes dug, and a fence placed in the bottom of it at such a depth as not to appear above the level of the ground. This is called a *sunk fence.* Sometimes a wall is built against a perpendicular side of a ditch, and some very light fence is placed obliquely outward near the top of it and level with the ground. This is called a *ha-ha fence*, a name given to it from the surprise excited in a person unacquainted with it, when he suddenly finds himself on the top of a wall with a deep ditch before him. When it is desired to keep off sheep or cattle from a lawn or pleasure-ground without obstructing the view of the park or the fields, the ha-ha fence is very useful."

Some persons recommend division fences for every ten acres, but this is ridiculously small, for it is not to be forgotten that the fence requires some room, hinders close ploughing, and this probably reduces the enclosure by one third to one half an acre, which, in a farm of two hundred acres, would amount to ten acres. Thirty or forty acre lots, except on small farms, are small enough.

FENESTRATE. In entomology, the appearance produced by the transparent spots on the wings of some insects. In botany, the absence of tissue between the veins of a leaf.

FENNEL, COMMON. *Meum fæniculum.* This is a well-known biennial plant, cultivated in kitchen gardens as a garnish, and used as a domestic medicine. The taste and aromatic qualities of the garden fennel are well known. The sweet and warm seeds are a common carminative for infants.

FENNEL, SWEET. *Fæniculum dulce.* This species of fennel is an annual plant, a native of Italy and Portugal, where it is cultivated as a pot-herb, as well as for the seeds and the oil which these afford. It is a smaller plant than the common fennel. The stem is somewhat compressed at the base. The fruit is much longer than that of the common fennel, being nearly five lines long, less compressed, somewhat curved, and paler, with a greenish tinge.

FENUGREEK. *Trigonella fænum-græcum.* Fenugreek is a species of trefoil, sometimes cultivated in fields for its seed; but it yields a very uncertain crop. The stem is a foot high, erect, with round, branched stalks, trifoliate leaves, toothed; the flowers small and white; the fruit a sessile, straight, erect, acuminate, flat pod, containing a number of yellowish seeds having a strong, disagreeable smell, and an unctuous, farinaceous, and somewhat bitter taste. These seeds are useful in cataplasms and fomentations.

FENUGREEK, RUSSIAN. *Trigonella ruthenica.* A hardy perennial, native of Siberia, with yellow papilionaceous blossoms in July and August. It loves a strong loamy soil and an open situation. It is propagated either by parting the roots in spring or from seed.

FERMENT. A substance in the state of decay which is capable of communicating fermentation and similar changes to other bodies. Ferments contain nitrogen, and are primarily derived from albumen, fibrin, or casein, which, when moist, decay spontaneously. The product of the ferment depends upon temperature, amount of water, access of air, and other conditions. These actions can only originate in organic matter, but ferments act upon inorganic substances, as mixtures of gases, &c. Ferments become exhausted in acting upon other bodies, from their own decay. For common ferment, see *Yeast.*

FERMENTATION. When a ferment, as yeast, is brought in contact with grape sugar, and several other principles, mixed with water, and at a temperature of 70° or upward, the sugar is changed, and gives off carbonic acid, alcohol being produced; this change is attended with considerable movement in the mixture, and is called fermentation. The product of fermentation is various: when alcohol is formed it is called *vinous;* when starch is converted into sugar, as in bread-making, *saccharine*. *Lactic acid fermentation* is when that substance is produced from sugar; *putrefactive* fermentation, which occurs in dunghills, takes place when nitrogen is an ingredient in the decaying matter.

Fermentation is a chemical change, whereby complex organic bodies are converted into more simple forms; thus, sugar is changed into carbonic acid and alcohol. It differs from *cremacausis*, in the circumstance that oxygen is only absorbed in the beginning, and that the changes take place in an abundance of water. The principal products of fermentation are water, carbonic acid, alcohol, and carburet of hydrogen. When nitrogen is present, ammonia, with fetid gasses, containing sulphur and phosphorus, are also exhaled. The heat is a result of these changes. The decay is hastened by warmth and an abundance of yeast; it is retarded by excessive moisture, and so high a temperature as to coagulate the ferments. Those bodies which absorb oxygen rapidly, as green vitriol, hinder fermentation by intercepting the first change: these are called *antiseptics*. Mineral acids also destroy the activity of ferments.

Sugar, starch, woody fibre, &c., cannot ferment spontaneously, for they contain no nitrogen; they are, however, called *fermentable*. The juices of fruits, trees, canes, &c., rapidly ferment, because, besides sugar, they contain albumen, casein, or fibrin, which, decaying easily, conveys the change to the fermentable matter present; but their fermentation may be hindered by adding a little lime, boiling down to a sirup, or otherwise coagulating or solidifying the destructive nitrogen principles.

In consequence of the continuance of fermentation, irrespective of access of air, fluids in this state must not be barrelled up tightly, or the carbonic acid gas may burst the vessel; but by lowering the temperature to 45° Fahrenheit (by placing in a cellar), separating all the yeast, or fumigating the cask with vapour of sulphur, it may be considerably or altogether arrested. The vinous fermentation runs into the acetous if the substances are freely exposed to air, as cider or beer in an open cask. See *Beer, Cider*.

FERNS, FILICES. Flowerless plants, with beautifully-developed leaves, bearing their seed-vessels on the lower side. They are cryptogamia in the system of Linnæus, and acotyledonous in that of Jussieu. They have little economical value, grow in wet or rocky situations, and serve well enough for packing, in the place of straw, or to increase the amount of yard manure.

FERROCYANATE OF POTASH. A yellow, crystalline salt, also called Prussiate of potash, the solution of which is used as a test for peroxide of iron in solution, with which it strikes a beautiful blue, being, indeed, Prussian blue. It is also used in the laboratory as a test for copper and other metals, and to form various compounds of cyanogen from.

FERRUGINOUS (from *ferrum*, iron). Containing iron, or of the colour of rust. Ferruginous waters are also called chalybeates, and much esteemed as tonics. Ferruginous soils, when friable, are frequently very fertile and improveable.

FERRUGO. Also *Rubigo, Rust:* it is a species of *uredo*.

FERRET. A useful animal of the weasel kind; the *Mustela furo* (*Fig.*) of naturalists. It is domesticated in

Europe for the destruction of rats, rabbits, and other small vermin, and might be usefully employed in the United States in granaries.

"It procreates twice a year, and brings from six to eight young; smells very fetid. The ferret is very susceptible of cold, and must be kept in a box provided with wool or other warm materials, and may be fed with bread and milk. Its sleep is long and profound, and it awakes with a voracious appetite, which is most highly gratified by the blood of small and young animals. Its enmity to rats and rabbits is unspeakable, and when either are, though for the first time, presented to it, it seizes and bites them with the most phrensied madness. When employed to expel the rabbit from its burrows it must be muzzled, as otherwise it will suck the blood of its victim, and instantly fall into a profound sleep, from which it will awake only to the work of destruction, committing in the warren, where it was introduced only for its services, the most dreadful waste and havoc. It is possessed of high irritability, and when particularly excited, is attended with an odour extremely offensive."—(*Loudon.*)

Ferrets are used in granaries and out-buildings to destroy rats. They are muzzled and slipped into the hole, from which they drive the animals, which are then caught by terriers or other vermin dogs. It is customary to hunt in the morning, when the rats are less active and asleep in their holes.

FESCUE GRASSES. The genus *Festuca*, containing several valuable, permanent grasses, of which the *F. pratensis*, meadow fescue, and *duriuscula*, hard fescue, are the best. See *Grasses*. The characters of the genus are, triandria, digynia, flowers in panicles, corolla armed, seeds adnate; calyx two-valved, many-flowered; spikelets compressed, roundish, awnless, or with a terminal awn; corolla sub-round, upper valve acute, with a sharp bristle at the tip, or mucronate, seed growing to the corolla. The valuable kinds are either indigenous, or have become naturalized; all the festucas are nutritious.

FETLOCK. "The part of the leg where the tuft of hair grows behind the pastern joint of horses: those of low size have scarcely any tuft. In working horses, which have them large, care should be taken to keep them clean in order to prevent the grease. The fetlock joint is a very complicated one, and from the stress which is laid on it, and its being the principal seat of motion below the knee, it is particularly subject to injury. An affection of this part should be well fomented and immediately blistered."—(*Clater.*)

FEVERS. A disease, one of the most general symptoms of which is increased heat of the body, and often the sensations of heat, dryness, and even burning of the skin are excessive, independent of any proportional increase of temperature. Their origin is in the nervous system. In fevers there is generally great constitutional derangement, unaccompanied by local or perceptible organic disease. Fevers generally begin with languor of body and mind; chilliness, amounting to shivering, though the skin often, at the same time, feels hot; the pulse is quicker than it should be; respiration hurried or laboured; pains are complained of in various parts, and especially about the head, back, and loins; the appetite falls off, or there is nausea and vomiting; the mouth is dry; the bowels generally constipated, and the urine small in quantity and deep in colour. These, which constitute the first stage, or ordinary febrile symptoms, are succeeded by alternate flushings, a quicker and fuller pulse, rapid alternations of shivering and burning heat, and by mental anxiety and wandering, which, under a great variety of aspects and modifications, constitute the second stage; they are succeeded by the third stage, in which the leading appearances are a cleaner tongue, a more natural pulse, a moist skin, calm mind, and the urine becomes more copious in quantity, and deposites a sediment as it cools. The symptoms of fever generally undergo an increase every evening, which is called an *exacerbation*; and this fluctuation often takes place more than once in the twenty-four hours, the violence of the attacks increasing with their occurrence, and forming what is called a *continued fever*. After some days, a *crisis* takes place, that is, the symptoms either take a favourable or an unfavourable turn. If the exacerbation and remission of symptoms are well marked, and occur once or oftener in the day, the fever is called a *remittent;* if the fever leaves the patient after some hours' duration, and returns at stated intervals, it is called an *intermittent*, as ague. Fevers are also variously denominated, according to the prevalent symptoms, as *inflammatory*, *typhus* or *putrid*, *nervous fever*, &c.; or according to cutaneous appearances connected with them, such as *scarlet fever* and *yellow fever*.

In the first stage, sweating medicines and purges, with bleeding, are useful; subsequently, medicines which calm the nervous system are used. Calomel, in a dose of 10 grains for a man, is often useful; but in fevers attended with great debility, bleeding is injurious, and stimulants, especially carbonate of ammonia (*sal volatile*), and wines, are essential.

FEVERFEW. Species of *Pyrethrum;* they are very similar, and may replace chamomile, especially the *P. parthenium.* Several bear ornamental flowers. They occasionally become troublesome perennial weeds, difficult to extirpate, except by repeated harrowings.

FIBRE, VEGETABLE. See *Lignin.*

FIBRIN. The principal constituent of muscles; it also exists in blood and some vegetables. When pure, it is white, inodorous, and insoluble, and, if perfectly dry, can be kept for any time, but when moist, it putrefies rapidly. See *Protein.*

FIBULA. The outer thin bone of the fore leg.

FICOIDEÆ. Tropical plants resembling the cactuses, inhabiting sandy plains.

FICUS. The generic name of the fig; hence *ficaria*, resembling the fig.

FIELD LARK. All the family of larks are devourers of grain, and therefore injurious to the farmer.

FIELDS. The enclosures made on an arable farm; they are seldom less than 20 acres, and in large farms become 50 or more.

FIELD MICE (*Avicola agrestis*, Cuvier, the short-tailed; *Mus sylvaticus*, Linnæus, the long-tailed species). They are a great nuisance to orchards, stripping off the bark near the ground, and causing the death of the trees. Tarring the parts is said to protect them; the introduction of a new ring of sound bark, the two being made to fit closely, after the injury, will often save the trees. Crows, hawks, owls, weasles, cats, and terrier dogs, as well as traps, are often insufficient to subdue these pests. The following method was found very successful in England after all others had failed: pits were dug 18 inches deep, two feet long, and 18 inches wide at the bottom, but with the sides inclined, so as to be only 16 inches long at the top and nine inches wide. The holes were made 20 feet apart each way, and were so successful that often 15 mice were taken in one during a single night: the mice falling in, were unable to escape up the inclined sides.

FIG. *Ficus carica.* Upward of 40 varieties are published of this fruit; of these, the Marseilles, early white, large white Genoa, purple Genoa, and Brunswick are worthy of cultivation. Most of these bear two crops in the season, from August to October. In the Northern States they require protection by glass or matting during winter, but may be cultivated as standards in Virginia and other parts of the South. The Malta is worthy of cultivation in the South as a crop, the fruit drying of itself on the tree if left, and becoming a fine sweetmeat. Figs are readily propagated by cuttings, *layers*, suckers, roots, or seeds. The layers will bear in one or two years. As standards, they are planted six to eight feet apart, in a dry, loamy soil. The fruit is hastened in ripening by pricking with a quill dipped in sweet oil, and is preserved for commerce by immersing for a moment in boiling lye.

The fig is peculiarly manageable,

the size and abundance of the fruit being almost entirely in the hands of the orchardist. By girding the stem-root, pruning, summer pruning the ends of the bearing branches, the abundance and beauty of the fruit are increased. In a stove it may be made to bear through the winter, so as to supply a constant succession. In pruning the ends of branches the juice will escape, unless the twig be first pressed between the thumb and finger till the tissues give way, and allowing it to wither before removal. Fig-trees are very liable to become luxuriant in foliage, bearing little fruit; this habit cannot be remedied by pruning the branches only, for this is calculated to increase their number; it is best rectified by training the branches horizontally, or even bending them downward by wires made fast to their extremities and to the ground or stem of the tree. Standards are pruned into a single stem and horizontal branches. The fig is remarkably free from insects. The tree is frequently taken up and laid down under three or four inches of earth for the winter, being set up in April. The wood is extremely hard and durable, being used for polishing metals when charged with emery.

FILARIA. A genus of intestinal worms, resembling a thread in appearance.

FILATURE. A reel arrangement for raw silk. See *Silk*.

FILBERT. *Corylus avellana.* This sweet and valuable nut could, with the fig, be readily made an object of exportation, or, at least, raised sufficiently to supply the great demand at home. As it is not much known, we insert a description of the best varieties:

1. Red Filbert.—Stem of the fruit red, superior in flavour to the white, but less prolific: requires light loam.

2. White Filbert.—An abundant bearer and hardy plant. The husk of the fruit is long and tubular, contracted near the top, so as to hinder the fruit falling out.

3. Cosford.—An improved hazel, the fruit deeply marked and almost conical.

4. Barcelona, or Large Cob.—A large nut, much esteemed for keeping, but often a shy bearer.

5. The Frizzled Filbert.—The husk is frizzled and ornamental. It is a modern esteemed variety.

The *C. Americana* is an indigenous species, bearing a sweet but small nut. The white is the market variety in England, and the Barcelona in Spain. Filberts require a deep, light, but naturally fertile soil, without putrescent manures. They should be grown as dwarf standards, set eight feet apart; the suckers and lower shoots which they constantly throw out should be restrained. They are propagated most readily from suckers, but may be grafted on seed stocks early in April. The amount of fruit yielded depends in a great measure upon pruning; for, naturally, the tree expends itself in producing under-wood. After raising the standard, with a low stem of twelve to eighteen inches, the branches must be pruned to the horizontal or pendant form: the leading shoots are annually shortened by two thirds; the front twigs are also summer-pruned, and all the spurs that have fruited removed in the winter or spring. It bears on spurs thrown out from the last year's wood. The fruit is ripe when the husk is turned brown; if intended for long keeping, the filberts are allowed to hang until fully brown, then dried by exposure to the sun, and placed in barrels with dry sand. An acre yields 800 to 1000 pounds of fruit. They bear in the fourth or fifth year.

The nut is assailed by a curculio in autumn, which may be seen boring the fruit to deposite its egg, and can be destroyed by shaking the tree and allowing chickens to eat the insect when fallen to the ground.

The filbert and hazel-nut (*C. sylvestris*) are distinct species, but by cultivation have become nearly mixed.

FILIFORM. Thread-like.

FILLY. A young mare.

FILTRATION. The separation of the clear portions of a solution or mixture from the precipitate or dregs, by passing through a close tissue. For chemical purposes, *white* blotting paper, called *filtering* paper, is used, folded into a conical form, and placed on a funnel. The fluid which runs through is called the *filtrate*. In quantitative analysis the filters are weighed before use, and when properly dried with the precipitate, and reweighed, give the amount of the latter with the best results. Sometimes the paper is burned with the precipitate, the known weight of its ashes being deducted from the whole weight. For common purposes, stout cotton cloth or porous earthen-ware are used.

FIMBRIATE (from *fimbria, a fringe*). Any long, fringe-like margin to animal or vegetable organs.

FIN. The cutting plate fixed before the mould-board of a plough, and answering for a coulter.

FINCHED. In stock, marked with white streaks.

FINGER GRASS. *Digitaria sanguinalis*. An unimportant plant, sometimes erroneously called cocksfoot. See *Grasses*.

FINGERS AND TOES. See *Anbury*.

FINOS. Second best wool from Merinos.

FIORIN. *Agrostis stolonifera*. A creeping, bent perennial grass. It was over-estimated by Richardson, and is unsuited for rotations, from its vivacious nature. See *Grasses*.

FIR. The European popular name for the larger pine-trees. See *Pine*.

FIRE-BLIGHT, FIRING. When the leaves of a growing plant or tree become brown and dead, either in part or entirely, it is said to be fired or fire-blasted. It is distinctly due to three causes: 1st. When it occurs in the lower leaves of a tall vegetable, the leaves have performed their office, and are no longer supplied with sap, and therefore die; 2d. It attacks growing leaves in spots or blotches: this is especially the case with tobacco, hops, &c. In these cases the weather has been wet and moist for some time, and becomes suddenly very hot; the firing occurs in July and August, during the hottest season. There is no doubt here that the first excess of sap during the wet days has ruptured the skin of the leaf or otherwise disorganized it, and the hot sun dries up the part, causing its death. 3d. The fire-blight of pear and other fruit trees is demonstrably due to numberless *aphides*, which, suddenly assailing the upper branches, destroy the leaves by their punctures, which then become brown by the action of the sun. The only resource is to prune the branches so infested, and destroy them at once.

FIRE-DAMP. The inflammable gas of bituminous coal-mines. Carburets of hydrogen.

FIRE-FANGED. Dried up. When manure, or composts, in which heat is generated, become too hot, the parts assume a baked appearance and ashy colour, and are said to be fire-fanged. The composts should be taken to pieces, mixed with a quantity of moist garden or fine soil, and put up in less heaps.

FIRE-FLY. *Elater noctiluca*. An herbivorous insect of the click or spring beetle genus.

FIRING. In farriery, a heathenish application of red-hot irons, practised by ignorant and brutal men, for the removal of sprains, &c. Its use almost amounts to a confession of ignorance.

FIRKIN. A measure of 2538 cubic inches, or $7\frac{1}{2}$ imperial gallons, being the fourth part of a beer barrel. Butter is packed in barrels called firkins, but weighed, not measured.

FIRLOT. A provincial, Scotch dry measure. The wheat firlot is only $\frac{99}{100}$ths of the bushel; the barley firlot is nearly $1\frac{1}{2}$ bushel.

FISH. On the seacoast fish is abundantly used as manure. The most common way is to spread the fish, and plough under in the course of a few days. The application made by the English farmers is from twenty-five to forty bushels per acre, but on Long Island much more is employed. This is, however, an extravagant way of using them. The best way is that adopted by Mr. Seely and Dr. Akerly on Staten Island, of strewing them in layers on compost beds with peat, ashes, slacked lime, charcoal, and vegetable matter. During a few months the animal matter of the fish is decomposed, and converted into rich ammoniacal manures without any offensive smell, and when it comes to be added to the soil, twenty bushels go farther and do more service than forty otherwise applied. All fish, sea urchins, crabs, shell-fish, &c., are of the greatest use, the animal matter being nearly identical in ultimate composition.

The fish owes its fertilizing effects to the animal matter and bone earth it contains. The former is precisely similar to flesh or blood, consisting of 25 per cent. fibrin, the rest being water. 100 pounds in decaying produce $2\frac{1}{2}$ pounds of ammonia, hence 400 pounds rotted in compost are enough for an acre. It may be applied with seed in drills, broad-cast over grass, wheat, &c. The great effect is due to the ammoniacal portion, for it renders the herbage dark-green, and starts it very rapidly. Arthur Young mentions several cases where fish caused the straw to grow so rapidly and long as to lodge; it should, therefore, be applied to well-tilled lands, which yield full grain. The refuse of fish prepared for salting is a valuable manure.

The refuse blubber, after pressing whale oil, coarse fats, train oil, has been used very successfully in composts on lands, but is very inferior to whole fish, which is, indeed, one of the finest manures known. In these cases composts are made with fine earth, coal ashes, or as above.

FISH-PONDS. Breeding and preserving fish in ponds is, in Germany and other states of Europe, an extensive and lucrative employment. In the United States it is a matter of luxury worthy of attention. Feeding or preserving ponds are without any remarkable peculiarity, except sufficient depth to allow enough water to remain unfrozen during winter; by embanking any spring branch such a pond can be produced. Breeding ponds are not always so successful; they should contain shoals for the young, be fed by a pure stream, often of soft water, and running upon a clean bottom; the shoals should be covered with rushes, and kept free from fowl, eels, and newts. The number of young produced, even by six spawners and three or four males to the acre, is such that predacious fish are introduced to thin them; for this purpose, trout and perch are much better than pike or pickerel, which latter find their way to the shoals and devour the spawn as well as the young. The contents of the breeding pond may be let off into a series of feeding ponds lying on a lower level. Perch and trout succeed together, but not with pike. Carp and tench are very easily raised in the same pond. Mr. Pell has cultivated shad in fresh water, and the flounder has also been naturalized in England. As a matter of course, on the seashore, salt-water ponds and fish can be procured. Pike and pickerel may be raised and preserved in a series of three or four ponds, being fed upon any small, common fish, which should be replaced as often as they are much destroyed.

The spawning season is from May to June, according to the fish, and the young should remain until the next year before removal to the second pond, where they remain two years, and are left to mature in the third. The last pond is often provided with a flood-gate, so that it can be effectually dragged by placing a net in this situation before letting off the waters. Another arrangement for securing the large fish only is to give the last pond such a figure as to allow a trap to be placed between two parts, so that all of a certain size are confined above or taken by the trap. The sides of the ponds should be sheltered by willows, elms, or other ornamental trees. The removal of the fish from one pond to another is made by dragging with fine nets.

The size of the fish will depend upon the amount left to the acre. In the second or nursing ponds 1000 to 1200 carp and 1500 tench will be enough per acre, and in the third pond 400 to 500 will be enough : these varieties will inhabit muddy waters. The perch and trout require clear waters ; 600 to the acre is an abundance. The varieties of fine bass, especially the Otsego, should be cultivated. Eels are worthy of ponds, and can be raised without any difficulty. Pike are to be cautiously excluded from ponds containing any of the foregoing fish, and all breeding places. The tench, carp, gold-fish, and gudgeon are frequently fed with meal, bread, and similar vegetable matters, when raised in small, heavily-stocked ponds. One pond answers well enough with all these kinds except pike and pickerel.

FISSIPAROUS GENERATION. That kind of generation which exists in polypes, hydras, &c., in which the parent throws out buds, or gemmules, which grow like itself, and are finally detached.

FISSIROSTRALS. A tribe of perching birds with a very wide gape, as the swallow.

FISTULA. "A long, sinous ulcer, often communicating with a larger cavity, and having a small external opening.

"All animals are liable to fistulas, but the horse more particularly so ; they attack the withers and the poll. They are produced by blows, by bruises from the saddle, and whatever causes inflammation ; also by the presence of extraneous substances.

"In curing this disease, it is requisite, in the first instance, to ascertain the direction the fistula pursues, and whether it materially interferes with any of the larger blood-vessels, so as to render a full incision into the parts a matter of too much hazard to be attempted. When secure from any danger of this nature, the most effectual practice is to lay the fistula, or fistulas, when more than one, so thoroughly open as to have a complete view of their internal surfaces. It is not, however, necessary in the simple sinus, where the matter is in a healthy state, and requires only a sufficient passago, but in cases where the discharge, by having been long detained, indurates and corrodes the contiguous parts ; as the means fully adequate to remove the former avail little in the radical cure of tne latter, a more severe practice, of course, becomes necessary.

"When the fistular cavities have been fully laid open by the knife, they should be dressed with powerful caustic compositions, until the wound presents a healthy appearance. Cleanliness, with more mild applications, should now be had recourse to, taking care that the wound be not closed before the cavities are properly and uniformly healed."

FIXED AIR. Carbonic acid. So called from its fixed condition in chalk, marble, &c.

FIXED OILS. Such as are not volatile. See *Expressed Oils*.

FLAGELLIFORM (from *flagellum, a whip*). A runner, or trailing stem, is so called.

FLAIL. A wooden implement for threshing grain, consisting of a handle, fastened by leather thongs to a moveable stick or swiple. It is a slow means of thrashing grain, and seldom used except for beans, which are rapidly beaten out.

FLAKE WHITE. Pure white-lead.

FLAME. The burning gases or vapours given off from fuel.

FLANDERS HUSBANDRY. "Flanders was remarkable for the cultivation of its soil long before any other country north of the Alps or Pyrences. This was the natural consequence of its commercial prosperity ; and although very little change has taken place, and very few improvements have been introduced for more than a century, it still ranks foremost among agricultural countries.

"It is not the richness of the soil which is the cause of the abundant harvests which the Flemish peasants reap, but their indefatigable industry. The greater part of the land in Flanders is naturally poor ; and in extensive districts, which now have the appearance of the greatest richness at harvest-time, the original soil was once little better than the blowing sands which are met with in the neighbourhood of the sea. Neither is it a genial climate which brings forward the fruits of the earth in abundance; for the climate is inferior to that of France or the southern parts of Germany.

"The soil may be divided into two classes. The first consists of the alluvial clay-loams near the coast; the second, of various sands and light loams which are found in the interior. The most fertile is that of the lowlands which have been reclaimed from the sea by embankments: it is chiefly composed of a muddy deposite mixed with fragments of marine shells and fine sea-sand. These lands are called polders, and their great natural fertility causes them to be cultivated with less art and industry than those lands which are much inferior.

"The cultivation in the polders has nothing remarkable to entitle it to much notice. Barley seems peculiarly suited to the soil, and very heavy crops of this grain are obtained, especially in those polders which, having been more lately embanked, are not much exhausted. Eight, and even ten quarters per acre have been obtained with little or no manure, and the second crop of barley sown in succession has often been the best. Oats are also very productive and of good quality, from ten to twelve quarters per acre. But these heavy crops soon reduce the natural fertility, and after a few years the produce is greatly diminished, and the land requires to be recruited by manure and cleansed by fallows. The usual rotation of crops in the polders consists of, 1. Winter barley after a fallow; 2. Beans; 3. Wheat; 4. Flax; 5. Clover; 6. Potatoes. If the potatoes have a favourable season, and the land can be cleared of weeds, the rotation begins again without a fallow year; but this is seldom the case, and the land is usually fallowed once in six years. The crops here mentioned are occasionally varied according to circumstances and manure, as well as the small quantity of dung made on the farm will permit. The polder farmer seldom thinks of purchasing manure, and even the ashes made by burning weeds are usually sold, to be sent to the poorer sandy soils, where their effects are more perceptible. When the polders have been too much exhausted, they are frequently laid down to grass, and in a few years a very rich pasture is produced. If, instead of sowing only a few refuse hay-seeds from the lofts, proper grass-seeds were sown, after land has been cleaned by a fallow, the pasture would much sooner come to perfection, and several years would be saved; but the improved modes of converting arable land into pasture, so advantageously practised in the north of England and in Scotland, are almost entirely unknown in Flanders. The extent of the farms in the polders is from 100 to 250 acres. The farmers in general are in good circumstances, and the buildings substantial.

"In the interior of East and West Flanders the soil varies considerably; but the principal part is of a sandy nature. The sand, and a heavier loam which scarcely deserves the name of clay, are found much intermixed, which is owing to an alternation of layers of sand and loam, which are found by digging to a considerable depth. These layers are not of great thickness, and the accidental circumstance of the washing away of the sand in some places and the depositions from the rivers in others easily accounts for this variety. Some of the elevations, which are nowhere considerable, consist of a very poor sand, and suggest the idea of their having once been the sands of the sea blown into hills, as is observable on the coast. These hills, if they may be so called, are naturally so barren, that they were, not very long since, covered with heath, or at best planted with fir-trees; but they have gradually been cultivated and improved, and only a few remain in their original state of heath or wood.

"The poorer sands have been brought into cultivation chiefly by the persevering industry of small proprietors and occupiers. Without an abundance of manure nothing can be effected there, and, consequently, every attention is paid to the procuring and collecting of it. The first process is always to trench the ground deep with the spade, and level it by means of the mollebaert, an instrument peculiarly Flemish, of which a drawing and description are given in the article *Barren Land*. The next step is to procure liquid manure, which consists of the urine of cows and horses, the drainings from dunghills, and the emptyings of privies. The numerous towns and villages which are scattered over Flanders, and the canals which intersect the country in all directions, facilitate the collecting and transporting of manure. A regular trade is carried on in everything which can enrich the land; nothing which can be of any use for this purpose is lost or wasted. In every farm there is a large vaulted cistern, in which the liquid manure is collected, and where it is occasionally stirred to excite fermentation, and make it more efficacious when it is carried upon the land.

"Experience has taught that manure put on light land in a liquid state is much more immediately effective than when the solid dung is ploughed in, but that its effects are also much less durable. This has led to the practice of frequently renewing the manure, and pouring the liquid over the growing crops as a top-dressing. Considerable care is required to give the proper quantity, and to regulate the strength according to circumstances; for too great a dose might destroy the crop, or produce great luxuriance on the leaf at the expense of the fruit or seed. The urine and other hot substances impregnated with saline particles are, therefore, diluted, if the weather is dry, before they are used, or they are poured over the soil some time before the seed is sown, that they may sink in and be more diffused.

"At a distance from large towns it would be impossible to obtain the requisite quantity of manure, and, accordingly, it is made on the farm. The cattle are the principal source of the supply; but every expedient is resorted to in order to increase the quantity and improve the quality. Every kind of vegetable or animal matter is carefully collected, and made to undergo the putrefactive fermentation by being mixed with others already partially decomposed. Nothing excites heat and putrefaction more than urine when it is poured over substances subject to decomposition. In every farm-yard there is a cavity or pit into which the objects to be acted upon can be thrown, and into which the urine or drainings of the dunghill can be made to flow: by frequently moving and stirring the mass, the decomposition goes on rapidly, heat is evolved, and the fibres and dried juices of vegetables are decomposed, and become soluble in water, in which state their effect on vegetation is greatest. The place in which this is going on is called in French a *croupissoir*, and in Flemish a *smoor hoop*. It is generally thought most advantageous that the manure should be ploughed into land in an active state of fermentation; and in order to secure this, it is in some places laid on the land in heaps, and each heap is moistened with urine. This soon renews the fermentation; and as soon as the heap begins to heat it is spread out, and the manure is immediately ploughed under.

"When the supply from the yard and from the vaulted cistern, together with what can be purchased, is not sufficient, recourse is had to the refuse cakes of colza from which the oil has been pressed out. These are dissolved in urine, or in water, and put into the cistern to decompose. When it is in a proper state, it is used chiefly on the land on which flax is intended to be sown, as it is a very rich manure, and perfectly free from the seeds of noxious weeds.

"In the tillage of the land the Flemings use few and very simple instruments. The common plough for light lands is a small, light foot-plough, so called from a piece of wood inserted in the beam, which is somewhat in the shape of a foot, or, rather, of the wooden shoe in common use in Flanders. It has no wheels, and is drawn by one or two horses. It is the parent of the Rotherham plough, from which most of the improved ploughs for light soils are derived. It is the most perfect plough for light sands, acting like a shovel at the fore part of the turn-furrow, which is concave, and completely turns over the soil.

"An instrument peculiarly Flemish is the *traîneau*. This is a wooden frame of a triangular shape, covered with boards, which is drawn over the ground to smooth the surface and press in the seed. The harrows in common use are also triangular, and made entirely of wood; the pins are driven obliquely, and point forward, so as readily to enter into the ground when the harrows are drawn by the angle. The blunt end of the pins projects about an inch or more on the side from which they are driven in: thus, by reversing the instrument, a slighter degree of harrowing is given, which has an effect intermediate between that of the harrows and the traîneau.

"The mollebaert, another Flemish instrument for levelling ground, has been already noticed. The Hainault scythe and hook are generally used for reaping corn. The instrument is held in the right hand and the hook in the left: by a swing of the arm the corn is cut close to the ground towards that which is standing; the hook collects it and rolls it up into a sheaf, which is taken up by means of the leg and the scythe, and laid down to be tied. It is better than a fagging-hook, and does the work more easily. These are the only instruments in common use which differ at all from those of other countries. None of the more complicated modern inventions have been introduced, nor would they be readily adopted, however ingenious or useful they might be; for an adherence to old established methods, and a repugnance to what is new, are nowhere so firmly rooted as among the Flemish peasantry.

"The most important instrument in Flemish agriculture is the spade, which is used to a much greater extent than in England, and in some instances is the only instrument of tillage. The trenching spade is made light and long, and is well adapted to the loose sandy soils. The first step to improvement is generally a complete and deep trenching; and in the Waes district a sixth part of the whole farm is trenched every year; and where this is not done, the intervals between the stitches in which the land has been ploughed are dug out with the spade a foot or sixteen inches deep, and the earth thrown evenly over the beds in which the seed has been sown. By shifting these intervals a foot every year, the whole of the land which lies in stitches six feet wide is dug, and the upper and under soil mixed regularly. This process is extremely useful in producing an even crop, especially of flax, the roots of which strike deep.

"The rotations adopted in light sands and loams are various. In the poorest and least improved, buckwheat, rye, and oats are the chief crops, with potatoes and clover, which require more manure. Every crop is manured except buckwheat, which grows well in the poorest soils, and becomes too luxuriant to give much seed in rich and highly manured lands. Bones have not been introduced except by way of experiment; but when their value on light soils shall be more generally known, especially in raising turnips, there is no doubt but they will be extensively used. This may lead to the folding of sheep to eat them on the land, and thus introduce an important improvement into Flemish husbandry.

"On the better kinds of light soils, which are not well adapted for wheat, the usual course is, 1st, rye, with turnips in the same year after the rye is cut; 2d, oats; 3d, buckwheat; 4th, potatoes or carrots; 5th, rye and turnips; 6th, flax; 7th, clover.

"When the sand becomes a good light loam, wheat is introduced in the rotation, after potatoes or after clover: the latter is thought the best practice, as the roots of the clover both enrich and consolidate the soil.

"Rye recurs more frequently than would be thought prudent if it were not for the turnips sown after it, which seem to correct the effect produced on the soil by the seeding of the rye; so that rye and turnips are sometimes followed by rye, in which clover is sown in the next spring. Thus rye and turnips may alternate in light lands, as beans and wheat sometimes do in rich heavy clays. The turnips are never eaten on the land where they grow, but are always drawn and housed in the end of September, the green tops being cut off and given to the cows and pigs, and the roots stored in dry cellars. The land is then immediately ploughed after some dung has been put on; and if oats are the next crop, which are sown in spring, it remains so all winter.

"When the land is of a better quality, although still in the class of light loams, wheat recurs more frequently, and the rotation is varied as follows: rye and turnips, potatoes, wheat, rye and turnips, oats, flax, clover, wheat. If the soil is fit for barley, this grain is substituted for rye. Carrots are frequently sown in the barley, and also in the flax: they strike deep into the rich light earth, but come to no size while the principal crop is on the ground. As soon as this is taken off, the land is harrowed and carefully weeded by hand: liquid manure, diluted if the weather is dry and warm, is spread over the surface, and in a short time the carrots throw out their green tops and swell in the ground: by the end of September a considerable crop of them may be dug up. The best variety for this purpose is a large white carrot, which rises some inches out of the ground: it has been lately brought into notice in England, and will, no doubt, soon be more generally cultivated. There is another variety, which is yellow, and also attains a good size; but it is inferior to the first in good ground. The quantity of roots raised for the winter provision of the cattle is considerable, and forms a very important part of the husbandry of Flanders, where all the cattle are constantly kept in the stables in winter, and, except where there are natural pastures, in the summer also.

"Flax is everywhere a most important crop, for it much exceeds all other crops in value. Where it can be raised of a tolerable quality, every other crop has a reference to this; and the rotation is arranged accordingly. There is no country where more attention is paid to flax than in Flanders, especially in the neighbourhood of Courtray. The land is brought into the highest state of richness and cleanness before flax is sown in it; and the most abundant manuring with rape-cake and urine is thought essential to raise this crop in perfection

"On the heavier loams, colza or rape is an important crop for the seed, from which the oil is expressed. It is sown in a bed in July or August, and planted out in rows two feet apart in October. The seed ripens early in the next summer, and a good crop of turnips may be had after it. The summers being in general warmer and drier than in England, the Flemish farmer is enabled to thrash out his rape-seed on a cloth in the field soon after the stems have been cut and laid gently on the ground to dry the pods. Any delay in this operation would cause a great loss: with every care and attention, much seed is always scattered in harvesting, because the pods do not ripen equally, and some will have shed their seeds before others are sufficiently ripe to be gathered.

"Potatoes were introduced into Flanders about the year 1740, and, from being at first only cultivated as a rarity, soon became an important part of the food of men and beasts. There is nothing peculiar in the Flemish mode of cultivating this useful root. The sets are planted with a blunt dibble: sometimes they are laid in the furrows and covered with the plough: they are always earthed up round the stems, sometimes by a plough with a mould-board on each side, but generally by hand with a broad hoe. The manure usually put on the land in which potatoes are to be set is double the quantity used for a corn crop; and a good soaking of the soil with urine is thought to invigorate the growth of the plant greatly. The produce, however, is not much more abundant than it is usually in those parts of England where potatoes are raised in considerable quantities in the fields—about 300 bushels on an acre. There is a small yellow potato in Flanders, which is excellent when boiled, and which grows well in a stiff loam, but it is not so productive as the large cattle potato.

"The cultivation of the sugar beet has been resumed lately, after it had been entirely abandoned. There are now several considerable manufactures of beet-root sugar; but it is not a favourite culture with the farmers, not even for their cattle, as it is too long on the ground. They prefer turnips and carrots, which can be raised on the same land which has borne another valuable crop the same year.

"In the heavier loams, which are chiefly to be met with in West Flanders and about Alost, the following rotation is adopted: flax, clover, barley or oats, beans, wheat, rye and turnips, potatoes, colza and carrots, flax; or flax, colza, wheat, rye and turnips, oats, clover, wheat, rye.

"Beans are not a favourite crop, and are not carefully cultivated. They are sometimes sown very thick, mixed with pease and tares, to be cut up in a green state for the cows and pigs; and in this way they produce a great quantity of green food, and clean the ground by excluding the air and smothering the weeds. On a farm of thirty-six bonniers, in a very good loamy soil near Courtray, the land was divided into six equal parts of six bonniers each, and the crops were distributed as follows:

Clover.	Wheat.	Wheat.
Carrots.		Beans.
Potatoes.		
Rye and Turnips.	Flax.	Oats.
	Colza.	

"The manure used for these crops was partly dung from the yard and cows' urine, but chiefly the sweepings of the streets and the emptyings of privies from Courtray.

"In a very rich loam, not far from Ypres, the following crops were noticed in regular rotation: 1, turnips with chicory and carrots; 2, oats; 3, clover; 4, wheat; 5, flax; 6, wheat; 7, beans; 8, wheat; 9, potatoes; 10, wheat; 11, oats. All these crops are of an exhausting nature, and it requires a very rich soil, aided by abundant manuring, to bear this rotation for any continuance; but each of these crops had a good portion of manure.

"Great attention is paid to prepare the land so as to secure a good crop from a small quantity of seed. The seed usually sown in Flanders is about one third less than in England, even when the seed is drilled, which it never is in Flanders. The ground is rendered mellow and rich by the tillage and the liquid manure; and the seed, which has been carefully selected, is covered by earth spread over it with the spade: it is afterward rolled or trod in with the feet. Every grain vegetates; and should there be any slowness in the growth, the urine-tank supplies an excellent stimulant. It is in the springing of the blade, after the farina in the seed is exhausted, that the liquid manure seems to produce the greatest effect. When the stem is shot up, it may, perhaps, too much encourage the increase of green leaves, and thereby hinder the formation of the flower and the seed: experiments made with liquid manure lead to this conclusion.

"There are some very rich pastures in Flanders about Furnes and Dixmude, where excellent butter is made. A great many beasts are fed in the summer, and a moderately-sized ox, turned out in good condition in April or May, will fatten on an acre of land by August or September. The best cows and oxen are of the Dutch breed; those which are bred in Flanders are inferior. The butter about Dixmude is churned from the cream only, although the most common practice is to churn the whole milk after it has stood some time and begins to be acid. It is always set in shallow pans immediately after milking, and left so twelve hours. The cream is then skimmed off, or the whole milk is poured into deep vessels till it is fit to be churned. The churning is performed in a barrel-churn or a plunge-churn: in either case, in the larger dairies, it is moved by a horse, which turns a wheel connected with the churn.

"The breed of horses in Flanders is large and heavy, but deficient in activity and clumsy in form. The mares were once in repute for heavy carriages, but at present, an equipage drawn by Flanders mares would be an object of wonder, if not of ridicule. Many horses have been imported into England from Flanders as cart-horses; but they were preferred chiefly on account of the price at which they could be obtained, and of the apparent bulk of them.

"The Flemish sheep are coarse in the wool, and much inferior in the carcass to the Leicester or South-Down. Some good sheep have been imported, which may much improve the native breeds. The pigs are as badly shaped as can well be imagined, long in the neck and head, and high on their legs. They are badly fed when young, and fatten slowly, although in time they acquire considerable weight. A better breed has been introduced, which will soon supersede the old.

"The farm-buildings are very good and convenient in general. The farms are small, compared with those in other countries; 120 acres are considered a very considerable occupation. In the Waes country, where the spade is extensively used in the cultivation of the land, the farms are very small, fifty acres being among the largest, and the average is not above fifteen. A farm of this description requires only one horse to cart the manure and plough the land; four or five cows are the usual complement, with two or three pigs. The cows are fed on clover in summer, and on barley or oats cut green; in winter, on potatoes, beet root, turnips, and carrots, which are chopped up together and boiled in a copper. This is given milk-warm three times a day, and is called brassin; when grains can be procured from the brewers, they are added to the mess. The cows never move from their stalls: after having had three or four calves, a cow is generally fattened and sold off; and a young heifer, of which a couple are reared every year, supplies her place."—(*W. L. Rham.*)

FLATULENCY. A diseased collection of gases in the stomach or bowels; change of food, slight purging, and tonics are best to remove it.

FLAX. *Linum usitatissimum* (*a*). An annual of the cruciferous family, the stems of which, when turning yellow, yield the finest staple, and a coarser article when ripe. The perennial flax (*L. perenne*) is coarser, but sometimes cultivated (*b*). The seeds, usually called linseed, yield the valuable oil of that name by pressure, and are, when bruised and boiled, one of the richest fattening fodders for cattle. The cake, after pressing for oil, is also a rich provender, scarcely equalled by any other for fattening. An acre yields six to twelve bushels of seed and 400 pounds of flax, the former worth $1 25 to $1 60

the bushel, and the lint eight to ten cents the pound.

It requires a mellow, rich soil, full of vegetable matter, ploughed deep; two bushels of seed are sown to the acre, and slightly covered with a bush harrow; when the object is to obtain fine green flax, but half a bushel will answer for seed only, and one and a half for coarse flax and seed. Sow early in May, and for the finest staple gather just after flowering, when the stems are yellow; for seed when dry: the amount of coarse stems is often very great, producing as much as half a ton of flax and tow to the acre. The plants should be weeded when three inches high. The following view of the profit is from the *Cultivator*, vol. i.:

"In 1835, Major Kirby, of Brownville, sowed six acres, partly upon stubble and partly upon green sward, with one ploughing—half a bushel of seed to the acre. The ground was well stocked with Canada thistles, which throve remarkably; yet, notwithstanding, the six acres produced him 108 bushels 12 pounds seed, and seven tons and three quarters of dressed flax. The proceeds of the crop amounted to $270

And the culture, pulling, and thrashing—the rotting being done by the manufacturer—to about 70

Leaving a profit of $200

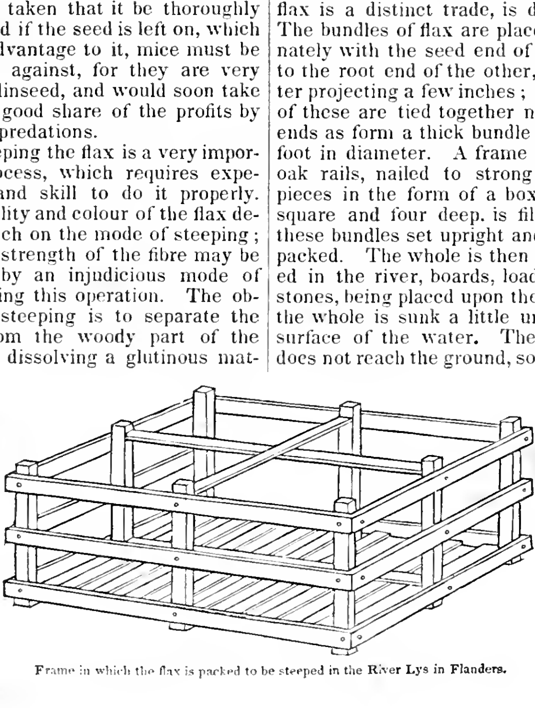
or 33⅓ per acre."

For the production of seed the soil must be a very rich wheat land, well broken and manured. It is a very exhausting crop, but if taken when yellow, or before seed, and the offal and steeping fluid returned, it is not so injurious to lands. The seed contains from 11 to 22 per cent. of oil, according to the season and richness of soil. See *Linseed*. By steeping, and other preparations, flax is reduced to 70 per cent. of the weight of the stems, and by hackling, to 50 pounds.

FLAX, PREPARATION OF. "When the flax begins to get yellow at the bottom of the stem, it is time to pull it, if very fine flax is desired, such as is made into thread for lace or fine cambric; but then the seed will be of little or no value. It is therefore generally left standing until the capsules, which contain the seed, are fully grown and the seed formed. Every flax grower judges for himself what is most profitable on the whole. The pulling then begins, which is done carefully by small handfuls at a time. These are laid upon the ground to dry, two and two obliquely across each other. Fine weather is essential to this part of the operation. Soon after this they are collected in larger bundles and placed with the root end on the ground, the bundles being slightly tied near the seed end; the other end is spread out that the air may have access, and the rain may not damage the flax. When sufficiently dry they are tied more firmly in the middle, and stacked in long, narrow stacks on the ground. These stacks are built as wide as the bundles are long, and about eight or nine feet high. The length depends on the crop; they are seldom made above twenty or thirty feet long. If the field is extensive, several of these stacks are formed at regular distances; they are carefully thatched at top, and the ends, which are quite perpendicular, are kept up by means of two strong poles driven perpendicularly into the ground. This is the method adopted by those who defer the steeping till another season.

Some carry the flax, as soon as it is dry, under a shed, and take off the capsules with the seed by *rippling*, which is drawing the flax through an iron comb fixed in a block of wood: the capsules, which are too large to pass between the teeth of the comb, are thus broken off, and fall into a basket or cloth below. Sometimes, if the capsules are brittle, the seed is beaten out by means of a flat wooden bat. The bundles are held by the root end, and the other end is laid on a board and turned round with the left hand, while the right hand with the bat breaks the capsules, and the linseed falls on a cloth below. The flax is then immediately steeped, but the most experienced flax-steepers defer this operation till the next season. In this case it is put in barns, and the seed is beat out at leisure in winter. When flax is housed, care must be taken that it be thoroughly dry; and if the seed is left on, which is an advantage to it, mice must be guarded against, for they are very fond of linseed, and would soon take away a good share of the profits by their depredations.

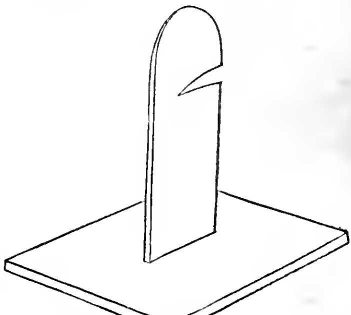
"Steeping the flax is a very important process, which requires experience and skill to do it properly. The quality and colour of the flax depend much on the mode of steeping; and the strength of the fibre may be injured by an injudicious mode of performing this operation. The object of steeping is to separate the bark from the woody part of the stem by dissolving a glutinous matter which causes it to adhere, and also destroying some minute vessels which are interwoven with the longitudinal fibres, and keep them together in a kind of web. A certain fermentation or incipient putrefaction is excited by the steeping, which must be carefully watched and stopped at the right time. The usual mode of steeping is to place the bundles of flax horizontally in shallow pools or ditches of stagnant water, keeping them under water by means of poles or boards with stones or weights laid upon them. Water nearly putrid was supposed the most efficacious, and the mud was often laid over the flax to accelerate the decomposition; but this has been found to stain the flax, so that it was very difficult to bleach it or the linen made from it afterward. The method adopted by the steepers of Courtray, where steeping flax is a distinct trade, is different. The bundles of flax are placed alternately with the seed end of the one to the root end of the other, the latter projecting a few inches; as many of these are tied together near both ends as form a thick bundle about a foot in diameter. A frame made of oak rails, nailed to strong upright pieces in the form of a box 10 feet square and four deep, is filled with these bundles set upright and closely packed. The whole is then immersed in the river, boards, loaded with stones, being placed upon the flax till the whole is sunk a little under the surface of the water. The bottom does not reach the ground, so that the



Frame in which the flax is packed to be steeped in the River Lys in Flanders.

water flows over and under it. There are posts driven in the river to keep the box in its place, and each steeper has a certain portion of the bank, which is a valuable property. The flax takes somewhat longer time in steeping in this manner than it does in stagnant and putrid water, and it is asserted by those who adhere to the old method that the flax loses more weight; but the colour is so much finer, that flax is sent to be steeped in the Lys from every part of Flanders. When it is supposed that the flax is nearly steeped sufficiently, which depends on the temperature of the air, the flax being sooner steeped in warm weather than in cold, it is examined carefully every day, and towards the latter part of the time several times in the day, in order to ascertain whether the fibres readily separate from the wood the whole length of the stem. As soon as this is the case the flax is taken out of the water: even a few hours more or less steeping than is necessary will make a difference in the value of the flax. If it is not steeped enough, it will not be easily scutched, and the wood will adhere to it. If it has been too long in the water, its strength is diminished, and more of it breaks into tow. The bundles are now untied, and the flax is spread evenly in rows slightly overlapping each other on a piece of clean, smooth grass which has been mown or fed off close. Fine weather is essential to this part of the process, as rain would now much injure the flax. It is occasionally turned over, which is done dexterously by pushing a long slender rod under the rows and taking up the flax near the end which overlaps the next row, and turning it quite over. Thus, when it is all turned, it overlaps as before, but in the contrary direction. It remains spread out upon the grass for a fortnight, more or less according to the season, till the woody part becomes brittle and some of the finest fibres separate from it of their own accord. It is then taken up, and as soon as it is quite dry it is tied up again in bundles and carried into the barn, to be broken and hackled at leisure during the winter.

"In the domestic manufactures the flax is broken or scutched at home when the weather prevents out-door work. The common brake consists of four wooden swords fixed in a frame, and another frame with three swords, which play in the interstices of the first by means of a joint at one end. The flax is taken in the left hand and placed between the two frames, and the upper frame is pushed down briskly upon it. It breaks the flax in four places, and by moving the left hand and rapidly repeating the strokes with the right, the whole handful is soon broken. It is then scutched by means of a board set upright in a block of wood so as to stand steady, in which is a horizontal slit about three feet from the ground, the edge of which is thin. The broken



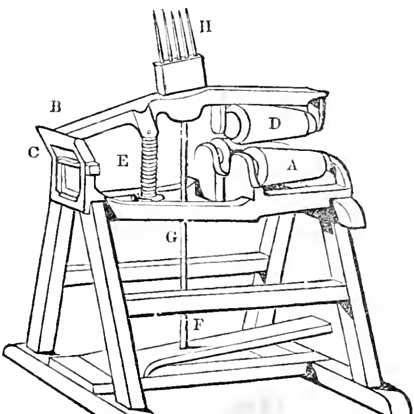
Upright board to clear the flax of the wood.

flax, held in handfuls in the left hand, is inserted in this slit, so as to project to the right, and a flat wooden sword, of a peculiar shape, is held in the right hand; with this the flax is repeatedly struck close to the upright board, while the part which lies in the slit is continually changed by a motion of the left hand. This operation beats off all the pieces of the wood which still adhere to the fibre without breaking it, and after a short time the flax is cleared of it and fit to be hackled; but the operations

Flat sword or scutcher.

of breaking and scutching are tedious and laborious when thus executed by hand. A mill is now used (where large quantities of flax are required for manufactures), having three fluted cylinders, one of which is made to revolve by horse or water power, and carries the other two round. The flax plants are passed between these cylinders while thus revolving, and the stalk, or *boon*, as it is technically called, is by this means completely broken without injuring the fibres. The scutching is accomplished in the same mill by means of four arms projecting from a horizontal axle, arranged so as to strike the boon in a slanting direction until the bark and other useless parts of the plant are beaten away. In the last process by which flax is prepared for the spinner, the *hackling*, the instrument employed, called the hackle, is a square piece of wood, studded with rows of iron teeth about four inches long, and disposed in a quincunx order. The fineness of the hackle is chosen with reference to the quality of the flax, and hackles differing in this respect from each other are used at different stages of the dressing, the coarsest first, and the finest to give the last degree of smoothness and finish to the flax. The operation of hackling is performed by the workman grasping a handful of flax by the middle, and drawing first one side or end and then the other through the teeth of the hackle, until every particle of extraneous matter is removed, and the whole of the filaments are arranged in distinct, even, and parallel fibres."

The following machine (see *Fig.*), patented by Mr. Bundy, is of great service in the domestic preparation of flax, and is constructed on the same principle as the implements driven by power. The frame is of wood, and sustains two conical rollers, of which A is seen; B is a beam moving around a joint at C, and carrying an upper roller, D; it is elevated by the spring E, and pulled down by the treadle F, which is connected to the upper piece by a metallic rod, G. The rollers are commonly grooved, each runs on its own pivot, and H is an iron comb for rippling. When used, a handful of the rotted flax is passed between the rollers and held in both hands; the foot being now ap-



plied to the treadle, the upper roller descends and presses on the fibres; the flax is next drawn to the right and left until sufficiently broken and cleared of harl; the foot is then raised and the fibres withdrawn to give place to a new lot.

Besides the water and dew rotting described, flax is prepared by steaming and by boiling in salt water. Boiling in lye or in soap and water is also employed, both to prepare the flax and improve the hackled staple. Water and dew rotting together require about three weeks; the water should be free from iron, which stains the staple.

Diseases.—Flax is not very subject to diseases; mildew and rust sometimes assail it in very damp seasons, and on a badly-drained soil; it is also preyed upon by a fly, but weeds, and especially *dodder*, are most injurious to the cultivation.

FLAX, SPECIAL MANURES FOR. Although a troublesome crop, flax is not severe upon the soil when raised for its fibre only, and, when well prepared, commands a good price. The great requisite for the fibre is a soil rich in decaying vegetable matter, but not rank with nitrogen. When seed is required, bone earth, and especially the soluble phosphates in urine and guano, or poultry dung, are extremely valuable.

By Dr. Kanes's analysis, the stems pulled before seeding contained

	Plants.	Seeds, Leuchtweiss.
Potash and soda	19·60	26·56
Lime and magnesia	20·12	25·49
Phosphoric acid	10·84	40·11
Sulphuric acid	2·56	1·00
Sand and other acids	46·88	6·84
	100	100

From these examinations, the great exhausting power of the seeds, by requiring so much phosphoric acid, is explained, as well as the value of the foregoing manures. Gypsum and ashes are also indicated in the cultivation of the fibre. When the steeping is carried on in ponds, the fluid becomes a rich manure for the crop, containing—as has been shown by Dr. Kane—nearly all the nitrogen and most of the saline matters, the prepared flax being nearly pure lignin; the fluid, therefore, as well as all the waste from hackling and breaking, should be preserved and used as manure. The waste of linseed cake, or the dung of cattle fattened thereon, is peculiarly appropriate as a manure for a crop of linseed; and when the oil is drawn on the farm and sold, the cake left contains all the enriching matters of the soil taken up by the seeds. Most plants of the flax family will yield more or less coarse staple.

FLAX, NEW ZEALAND. See *New Zealand Flax.*

FLAX, OREGON. Mr. Parker, travelling in Oregon, describes fields of a perennial flax precisely resembling the *L. perenne* (*b*); the roots are so firm that it cannot be pulled, but may be mowed, yielding annual crops.

FLAX, PURGING. An English weed (*L. catharticum*), the root of which is purging.

FLAXSEED. See *Linseed.*

FLAX, FALSE. See *Yellow Seed.*

FLAX, TOAD. A weed. The *Thesium umbellatum. Linaria vulgaris* is also called yellow toad flax.

FLEAS. A species of the genus *Pulex*; they are wingless, but undergo regular transformations. Cleanliness, especially in the removal of old straw and similar bodies in which they harbour, washing the skins of animals, anointing with mixtures of oil and pennyroyal or elder leaves, are effectual means to reduce their numbers.

FLEABANE. A name given to many weeds, as the *erigerons, inulas*, &c.

FLEA BEETLE. The genus *Haltica*, species of which infest turnips, cucumbers, &c.

FLEAM. The knife or lancet used in bleeding cattle and horses.

FLECKED. Pied, or of mixed colours.

FLEECE. The wool of a sheep. See *Sheep* and *Wool.*

FLEMISH HUSBANDRY. See *Flanders Husbandry.*

FLESH. Commonly the mixed

muscle and fat of animals, but more strictly the muscle or lean only. Lean meat consists of 20 per cent. fibrin, with three per cent. of albumen, colouring matter, and salts: the rest, 77 per cent., being water: it differs very little from *blood*. Waste flesh or garbage should be added to the compost heap, with lime and earth; 100 pounds yield 3¼ pounds of ammonia during decay, and therefore, when composted, 400 pounds will be enough for the acre.

FLEXIBILITY. The capacity of bending without breakage. It is a relative property, depending upon temperature, thickness, &c.

FLEXORS. The name of those muscles which produce the flexion or bending of the arm or leg.

FLEXUOSE. Full of bendings to the one side and the other.

FLIES. Insects furnished with two wings (*Diptera*), and living by suction, or on animals and meats. Several distinct families exist, viz., the *Tachinadæ*, which deposite their eggs in caterpillars; the *Sarcophagæ*, which are viviparous, producing living maggots, and living on putrid meats. One fly often produces 20,000 young. The *Stromoxys* genus, including the sharp stinging horseflies, which lay their eggs in dung; the *Muscadæ*, or house and meat flies, which infest butchers' stalls and houses: the latter lay eggs in dung. The house fly is readily destroyed by exposing plates of infusion of quassia, green tea, &c., sweetened, or introducing some active poison, as arsenic or corrosive sublimate, into molasses and water: they also avoid dark rooms.

FLIGHTS. The husk or glumes of oats are so called.

FLINT. A variety of *silica*, containing water and stained with iron, found interstratified with chalk in Europe, but not discovered in America.

FLINT GLASS. A glass composed of fine sand and red-lead, having a high refractive power, and used by opticians.

FLITCH OF BACON. The side, or shoulder, and middling together.

FLOAT. A raft of timber to be floated. To cover meadows with water.

FLOAT BOARDS. The boards attached to the circumference of an under shot-wheel.

FLOCCUS. The loose hair at the end of the tail of some animals.

FLOODGATE. Any contrivance or gate to regulate the flow of water; a sluice. A common floodgate is depicted in *Irrigation*.

FLOODING. See *Irrigation*.

FLORETS. The flowers of a capitulum, like the sunflower.

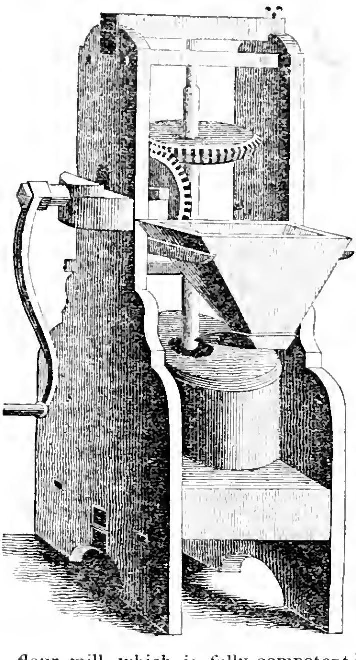
FLORIDA ARROW-ROOT. See *Sago*.

FLOSS SILK. The silk broken off from cocoons in the filature, which is carded and worked like cotton, for coarse fabrics.

FLOUR. The meal of wheat, for the most part. The amount of flour made by a variety of grain is a prime consideration, some kinds producing more than others. On an average, a bushel of sixty pounds yields, of family flour, forty-eight pounds; of pollard, eight pounds; bran, three pounds, and a loss of about one pound. The finest is that from wheat cut in the dough, which also weighs from three to five pounds more the bushel, is whiter, and softer to the touch. The true value of flour is, however, its *gluten*, which is the nutritious portion. Common kinds rarely exceed twelve per cent.; but of choice kinds, some furnish thirty; the amount is determined by washing a piece of dough on a fine hair seive until water runs through it without milkiness; the remaining portion, which is very tenacious, consists of impure gluten; it should be dried at 300, and weighed. There is not a finer flour than that produced from the white flint varieties of wheat, and white May.

A barrel of flour should contain 196 pounds. The sack, which is used in England, contains 280 pounds.

FLOUR MILL, A HAND. The figure represents a very neat hand



flour mill, which is fully competent to produce fine flour. It is patented by Nichols and Marsh. Price, $40.

FLOWER. In botany, the expanded bud. For its different parts, see *Botany*. In descriptions, flowers are divided into apetalous, monopetalous, polypetalous, and composite; the first includes those without corolla; the second, consisting of one petal apparently, are, in truth, formed by the union of several, and hence termed *synpetalous*; this class is subdivided into numerous kinds, as *labiate*, like the *sage* flower; *personate*, like *antirrhinum*; *wheel-shape*, like *borage*; *campanulate*, like a bell; *hypocrateriform*, like the tobacco blossom. Polypetalous flowers consist of several distinct petals, and are called *rosaceous*, when like the rose flower; *caryophyllous*, like the pink; *liliaceous*, like the lily; *cruciferous*, like flax or cabbages; *papillonaceous*, like the pea; *orchideous*, like the genus orchis, &c. Composite flowers are like the sunflower, lettuce, thistle, &c. The essential parts of the flower are the stamens and pistils; if both are present, it is hermaphrodite; if one is absent, they are either male or female blossoms; and the absence of both constitutes the blossom a *barren* flower. By development, single flowers become double, but they also become barren, the stamens being converted into petals. The colour of flowers is very much in the hands of the florist; for, by hybridizing species of different colours, the seed produced often gives rise to varieties of new tints.

Flowers, in chemistry, are fine crystals, obtained by sublimation.

FLOWERLESS PLANTS. The cryptogamous plants of Linnæus; the acotyledons of Jussieu.

FLUE. A channel or way along which the smoke or heat of a fire passes. See *Hot-house*.

FLUID. A body the particles of which move freely among one another, and which transmit pressures equally in all directions. Fluids are divided into elastic and non-elastic, or gaseous and liquid; the former containing air and vapours, the latter water, &c.

FLUKE. *Distoma hepaticum.* Gourd-worm. A flat, entozoal worm, infesting the livers of sheep and some other animals; it is often seen in those which have died of the rot.

FLUORINE. A hypothetical body, supposed to resemble chlorine, found in fluor spar. With hydrogen, it forms a very corrosive acid, the hydro-fluoric, which acts upon glass, forming fluo-silicic acid, and is a powerful caustic. It exists, in minute quantity, in bones. Its compounds are called *fluorides*.

FLUOR SPAR. A beautiful crystalline mineral, abundant in Derbyshire, England, and hence called Derbyshire spar. It is common in New-York and the Eastern States; consists of fluoride of calcium. The mineral is of many colours, and cubical or octahedral in form. It is used as a flux, and to procure hydro-fluoric acid, and has been recommended as a manure.

FLUTINGS. The grooves of columns.

FLUVIALES. A tribe of water plants, of endogenous structure, nearly resembling sea-weeds. Sea wrack (*Zostera marina*) is used, when dry, to stuff cushions and for packing.

FLUX. In chemistry, substances which are in themselves very fusible, or which promote the fusion of other bodies. When cream of tartar is deflagrated with half its weight of nitre, a mixture of charcoal and carbonate of potash remains, which is often called *black flux:* when an equal weight of nitre is used, the whole of the charcoal is burned off, and carbonate of potassa remains, which, when thus procured, is called *white flux*.

Flux, in diseases, any unusually increased discharge, as diarrhœa.

FLY. In agriculture, any winged insect injurious to crops, as the turnip, wheat, Hessian *fly*, &c., for which see the plants respectively.

Fly. In machinery, an appendage given to machines for the purpose of regulating and equalizing the motion, as in the windlass, jack, pile engine, &c.; and sometimes for collecting force in order to produce a very great instantaneous impression, as in a coining press. Generally it is formed of a heavy disk or hoop, attached to the axis; sometimes of heavy knobs at the extremities of a bar having the same position. The fly is of great use in all cases where the power or the resistance acts unequally in the different parts of a revolution.

FLYING BUTTRESS. A beautiful and useful portion of a Gothic structure, consisting of arches thrown off from a mass of masonry against a wall, to support it from pressure acting from above, as by the roof.

FLY POWDER. Black suboxide of *arsenic*, used to kill flies, but dangerous, from its poisonous nature.

FOAL. A young horse.

FOALING. The act of parturition or bringing forth young in the mare. Good feeding and moderate exercise are found to be the best preventives against slinking, which is most prevalent when half the time of pregnancy has elapsed. If a mare has been regularly exercised, and apparently in health while she was in foal, little danger will attend the act of parturition. If there be false presentations of the fœtus, or difficulty in producing it, it will be better to have recourse to a well-informed doctor, rather than injure the mother by the violent and injurious attempts which are often made to relieve the animal. As soon as the mare has foaled, she should be turned into some well-sheltered pasture, with a hovel or shed to run into when she pleases; and as, supposing she has foaled in April, the grass is scanty, she should have a couple of feeds of corn daily. The mare may be put to moderate work a month after foaling.

FOCAL DISTANCE. In optics, the distance between the centre of a lens or mirror and the point into which the rays are collected.

FOCUS. A point where heat, light, sound, &c., are collected, either by the action of glass or reflecting surfaces. In geometry, certain points in the curves, called conic sections, which are also foci for radiant emanations.

FODDERS. All substances used as food for animals. In some parts of the United States it is, however, confined to the leaves stripped from corn. Coarse fodders are those which resemble straw, &c., occupying much bulk.

The *comparative value* of fodders is a prime question in husbandry, and which can hardly have been said to assume a trustworthy estimate until recently, when careful experiments have been made by Thaer, Raumer, Block, and Boussingault. In the annexed table, by the latter, are shown the results obtained by chemical examination and practical feeding. In the first, the amount of nitrogen in 100 parts is found, which gives the quantity of fibrin, albumen, and casein, by multiplying by 6·3; thus, in the table, the nitrogen in good hay is 1·34 per cent., which is equivalent to

TABLE OF THE NUTRITIVE EQUIVALENTS OF DIFFERENT KINDS OF FODDERS.

Kinds of Food.	Standard water per cent.	Nitrogen per cent.	Nitrogen per cent. in the article not dried.	Theory.	Block.	Petri.	Meyer.	Thaer.	Pabst.	Various.
Ordinary natural meadow hay	11.0	1.34	1.15	100	100	100	100	100	100	
Do. of fine quality	11.0	1.50	1.30	98	—	—	—	—	—	
Do. select	18.8	2.40	2.00	58	—	—	—	—	—	
Do. freed from woody stems	14.0	2.44	2.10	55	—	—	—	—	—	
Lucern hay	16.6	1.66	1.38	83	—	90	—	90	100	90, 90 Dombasle, Crud.
Red clover hay, 2d year's growth	10.1	1.70	1.54	75	100	90	—	90	100	
Red clover cut in flower, green, do.	76.0	—	0.64	311	430	—	—	450	425	
New wheat straw, crop 1841	26.0	0.36	0.27	426	200	360	150	450	300	500 Rieder.
Old wheat straw	8.5	0.53	0.44	235	—	—	—	—	—	
Do. do. lower parts of the stalk	5.3	0.43	0.41	280	—	—	—	—	—	
Do. do. upper part of do. and ear	9.4	1.42	1.33	86	—	—	—	—	—	
New rye straw	18.7	0.30	0.24	479	200	500	150	666		
Old do.	12.6	0.50	0.42	250	—	—	—	—	—	
Oat straw	21.0	0.36	0.30	383	200	200	150	190	200	400 Schwertz.
Barley do.	11.0	0.30	0.25	460	193	180	150	150	200	400 do.
Pea do.	8.5	1.95	1.79	64	165	200	150	130	150	90 Pohl.
Millet do.	19.0	0.96	0.78	147	—	250	—	—	—	
Buckwheat do.	11.6	0.54	0.48	240	—	200	—	—	—	
Lentil do.	9.2	1.18	1.01	114	160	200	—	130	150	
Vetches cut in flower and dried into hay	11.0	1.16	1.14	101	—	125	—	—	100	
Potato tops	76.0	2.30	0.55	209	—	300	—	—	—	
Field beet leaves	88.9	4.50	0.50	230	600	—	—	—	600	
Carrot do.	70.9	2.94	0.85	135	—	—	—	—	—	
Jerusalem artichoke stems	86.4	2.70	0.37	311	—	—	—	—	325	
Lime-tree, young shoots	55.0	3.25	1.45	79	73	—	—	—	—	
Canada poplar do.	62.5	2.29	0.86	134	67	—	—	—	—	
Oak do.	57.4	2.16	0.92	125	83	—	—	—	—	
Acacia do. (autumn)	53.6	1.56	0.72	160	—	—	—	—	—	
Drum cabbage	92.3	3.70	0.28	411	556	500	250	429	600	
Swedish turnip	91.0	1.83	0.17	676	—	300	—	300	250	
Turnip	92.5	1.70	0.13	885	533	600	290	526	450	
Field-beet (1838)	87.8	1.70	0.21	543	306	400	250	460	250	
Do. white Silesian	85.6	1.43	0.18	669	366	—	—	—	—	
Carrots	87.6	2.40	0.30	382	205	250	225	300	250	380 Boussingault.
Jerusalem artichokes (1839)	79.2	1.60	0.33	348	—	—	—	—	—	280 do.
Do. (1836)	75.5	2.20	0.42	274	—	—	—	—	—	
Potatoes (1838)	65.9	1.50	0.36	319	216	200	150	200	200	280 Boussingault.
Do. (1836)	79.4	1.80	0.37	311	—	—	—	—	—	
Do. after keeping in the pit	76.8	1.18	0.30	383	400	—	—	—	—	
Cider apple pulp dried in the air	6.4	0.63	0.59	195	—	—	—	—	—	
Beet root from the sugar mill	70.0	—	0.38	303	—	—	—	—	—	
Vetches in seed	14.6	5.13	4.37	26	30	54	—	65	40	
Field beans	7.9	5.50	5.11	23	30	54	50	73	40	
White peas (dry)	8.6	4.20	3.84	27	30	54	48	66	40	
White haricots	5.0	4.30	4.58	25	—	39	—	—	—	
Lentils	9.0	4.40	4.00	29	—	—	—	—	—	
New Indian corn	18.0	2.00	1.64	70	—	52	—	—	—	59 Boussingault.
Buckwheat	12.5	2.40	2.10	55	—	64	—	—	—	
Barley (1836)	13.2	2.02	1.76	65	33	61	53	76	50	
Barley-meal	13.0	2.46	2.14	54	—	—	—	—	—	
Oats (1838)	20.8	2.20	1.74	68	—	71	—	86	60	
Do. (1836)	12.4	2.22	1.92	60	—	—	—	—	—	
Rye (1838)	11.5	2.27	2.00	58	—	—	—	—	—	
Wheat (1836, Alsace)	10.5	2.33	2.09	55	27	52	46	64	40	
Do. from highly manured soil	16.6	3.18	2.65	43	—	—	—	—	—	
Recent Bran	37.1	2.18	1.36	85	105	—	—	—	—	Some specimens are twice as rich.
Wheat husks or chaff	7.6	0.94	0.85	135	160	—	—	—	—	
Rice (Piedmont)	13.4	1.39	1.20	96	—	—	—	—	—	
Gold of pleasure seed (Madia)	8.0	4.00	3.67	31	—	—	—	—	—	
Do. cake	11.2	5.70	5.06	23	—	—	—	—	—	
Linseed cake	13.4	6.00	5.20	22	42	180	—	—	—	
Colza do.	10.5	5.50	4.92	23	—	—	—	—	—	
Madia do.	6.5	5.93	5.31	21	—	—	—	—	—	
Hemp do.	5.0	4.78	4.21	27	—	—	—	—	—	
Poppy do.	6.8	5.70	5.36	21	—	—	—	—	—	
Nut do.	6.0	5.59	5.24	22	—	—	—	—	—	
Beech mast do.	6.2	3.53	3.31	35	—	—	—	—	—	
Arachis (Pindars) do.	6.6	8.89	8.33	14	—	—	—	—	—	
Dry acorns	—	—	0.80	143	—	—	—	—	—	
Refuse of the wine-press, air dried	48.2	3.31	1.71	68	—	62	—	—	75	

8½ nearly of fibrin. The practical values are ascertained by weighing the feed and animal, and giving enough of all fodders to maintain him in good condition. They are less true than the theoretical or chemical values, because not so well performed ; but the theoretical values have been fully sustained by subsequent examination. One hundred pounds of ordinary hay are made the standard, other fodders being compared with this in their power of sustaining life in animals. The fodders are, however, of different values, for *fattening*, *wool-growing*, &c., and are treated of as such under these heads. The difference exhibited in the above valuations, by different authors, is, in a great measure, due to variations in the nutritiousness of the provender ; thus, straw, pea haulm, &c., are many times more nutritious when cut greenish than when dead ripe. In the same way, some wheat contains 10 and some 30 per cent. of gluten ; and here is a difference of 1 to 3.

The following articles, used as human food, are equivalent to one hundred of good flour. The term meal is meant to indicate that the substances were perfectly dried and pulverized : the equivalents are constructed upon the relative amounts of nitrogen in fair samples of each :

Wheat flour (good quality)	100
Wheat	107
Barley meal	119
Barley	130
Rye	111
Buckwheat	108
Indian Corn	138
Yellow peas	67
Horse-beans	44
White French beans	56
Rice	171
Lentils	57
White-heart cabbage	810
Cabbage meal	83
Potatoes	613
Potatoe meal	126
Carrots	757
Carrot meal	95
Turnips	1335
Mealy bananas	700
Manihot (casava plant)	700
Yam (dioscorea)	300

In the economy of food, not only ought a proper selection to be made to suit the object of the farmer as oily provender for fattening, fodder rich in gluten for draught animals, but the greatest attention should be paid to warmth, exposure, and the losses of free pasturage. See *Soiling* and *Food*.

FODDERS, THE TIME OF CUTTING. The old careless practice of allowing corn, wheat, beans, &c., to stand until dead ripe is giving place to the more rational method of cutting when the herbage is turning yellow, and the stem is dried an inch or two above the ground. Not only is the grain, whether wheat, oats, or corn, much heavier, but whiter, and preferred, but the straw, haulm, or fodder is increased in value from four to ten times ; thus, while the dry, brown stems of pease are of no value in husbandry, it is the opinion of the best Scotch farmers that the same stems, taken when just yellowed, are twice as valuable as hay ; and chemical examination shows this to be a true estimate. Hay cut in flower is worth twenty per cent. more than that cut in seed, and twice as much as that with dry stems : the same is true for clovers, lucern, and all coarse fodders. Straw is obtained nearly as good as hay when cut in the light greenish yellow state ; but when seed grain is wanted, the straw must be allowed to dry perfectly.

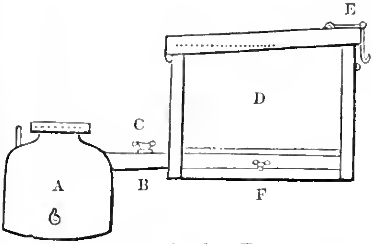
FODDERS, THE PRESERVATION OF. The preparation of hay will be explained under that head. In putting it up for winter use, there are two plans, either to house it in a barn or stack it. Against the latter considerable prejudice exists, chiefly because of the loss occurring from the exposure of the outer stems. But stacking is a perfect means of preservation, and in all senses equal to storage in a barn, if properly managed ; it is only when little stacks, imperfectly covered, and placed on the ground, are used, that the system is objectionable. The hay, &c., when stored, should be withered, but not crisp, and thoroughly dry : in putting up, a peck of salt to the load is of great service in hindering mildew and flavouring the hay. Large mows must be provided, with means of ventilation, by having beams or rods passing through the barn, unless the hay be well made and cured before storage. When well cured, hay should be of a greenish yellow, fine odour, and altogether free from blackness or mildew.

Much advantage is gained by making up stacks of succulent fodders, like buckwheat, Jerusalem artichoke stems, broad-cast corn, clover, pea, and bean stems, with straw, piling one layer on the other; the fodder may thus be put up fresher without being sun-burned, and the straw is improved, at the same time that heating is obviated. Salting, in these cases, is an additional preservative.

There is no greater injury to coarse fodders than allowing them to lie in swarth until crisp and black from drying; their nutritive matter is thus reduced very considerably, and the hay becomes unmanageable. If, from using grass too green, it should heat, the stack must be taken down and freely exposed to the air as soon as the accident is discovered, otherwise it may fire, or, at least, the fodder contracts a pitchy taste disagreeable to cattle.

FODDERS, THE PREPARATION OF. A great deal has been said of late concerning the cooking and steaming of food for horses, oxen, and farm animals. Much is the offspring of ignorance and superficial examination. The preparation of corn and hard grains, when given to oxen and pigs, by grinding, is unquestionably a matter of great economy, whereby at least one half is saved in the former case. Mechanical reduction by grinding, pounding, cutting, and crushing, is also of great value in other fodders, in roots, succulent stems, and herbs; but the assertion that the act of steaming, irrespective of the fineness of the food, is of great service, or even that it will pay for fuel in the case of the horse and oxen, is disproved by the examination of numerous Scotch farmers and by Boussingault. Every kind of comminution is valuable, because oxen are incapable of pulverizing grains, and horses frequently *bolt*, or swallow whole, the carrots, beets, parsnips, &c., which it is customary to furnish them. This also refers to sheep. It is true that in winter some little warmth is obtained from the fluid if given hot, but this is not enough to pay for the trouble. A machine for rasping beets, potatoes, &c., is worth infinitely more than a cooking contrivance.

With pigs the matter seems to be different; well-made experiments show that boiling or steaming food hastens their fattening; but this is scarcely understood. Boiling does not develop any nutrition; on the contrary, Dr. Beaumont has shown that digestion is retarded; but boiling is of service where oily food, as *Indian corn*, *linseed*, *hemp seed*, *cotton seed*, &c., is given, for the heat causes the particles of fat of the meal to form an emulsion with the hot water and gum of the seed, and it is readily taken up by the animal's intestines, whereas oil, in large quantity, is not so readily absorbed by the body, but partly rejected. From the same cause, in the last stage of fattening oxen, corn or linseed meal, boiled into a jelly or porridge, will assist fattening, while it is in no way calculated as a regular fodder for draught oxen. In so far as boiling or steaming assists digestion, comminutes food, by making it mealy, as potatoes, or produces an emulsion with the oil it contains, so far, and no farther, does it do service on the farm. Practical men state the gain in oily meals, with pigs, at about one third, but not so much, if at all, in coarse fodders. For cooking, nothing is superior to Mott's stove, which heats rapidly and economizes fuel. For a *steamer*, any common kettle, the nozzle of which empties into a box either of thick wood with a tight lid, or into a barrel, will answer; the barrel may be surrounded with tow or cloth to keep in the first heat. The figure represents such a contrivance: A is a kettle, communicating by the pipe, B, furnished with a stop-cock at C, into the box, D, the lid of which overlaps, and is



made fast by hooks, E. It is also furnished with a stop cock, F, below, to let off the condensed water.

Such a contrivance can be set up in the feeding-house on a table, and easily used, the food being conveyed down an inclined plane to the feeding-troughs, or along a hose, if it be fluid. A rapid way to make water boil is to place it in a tube of tinned iron or copper, wound into a spinal form, and running around the fire; in this way the amount of surface is greatly increased, and the whole brought near to the fire.

FŒTUS (from *feo, I bring forth*). A quickened child in the womb.

FOG. A collection of vapour near the earth's surface, produced by the cooling of the moisture in the air. Fogs lie in the morning and evening over damp, ill-drained, or marshy lands, and are unhealthy, producing ague and bilious fevers.

FOGGE. Long grass and partially cropped grass remaining on meadows. Also the grass after a crop.

FOGGING. An uncommon practice of leaving the grass of upland meadows uncut during the year, and turning cattle and sheep upon it in the fall and winter.

FOIL. A thin sheet of metal.

FOLD. A temporary enclosure made with hurdles or rails, to confine sheep. A portion may be sheltered with pine or other branches, and littered with straw.

FOLDING. The practice of enclosing sheep, cows, &c., in folds, either for the night to manure the land, or on turnips, grass, spring rye, wheat, &c., to eat it regularly and manure at the same time. Folding during summer is wasteful; for the greater part of the urine is lost, and much of the solid excrement decays and is volatilized or removed by washing; driving the cattle to one yard and receiving the dung on straw, charcoal, or suitable matters for composting it, would be much better economy. On heavy lands, the treading of animals is frequently injurious during folding.

FOLIATION, or VERNATION. The manner in which the young leaves are folded in the bud.

FOLLICLE, or FOLLICULUS. In botany, a one-valved, one-celled, many-seeded, superior, dehiscent fruit.

FOMENTATION. A warm bathing applied to a part of the body: infusions of herbs are often used.

FONTANEL. A small space existing between the bones of the head in the fœtus.

FOOD. A substance which contains any of the principles which exist in the body, is digestible, and not combined with a poisonous ingredient. There are three principal varieties of food: 1st. That capable of repairing the waste of the flesh or muscle, called *Azotized* food, and essential to the strength of animals. 2d. That which sustains the heat of the body, called *non-Azotized* food. 3d. That which repairs the waste of fat, and called *Oleaginous* food, the importance of which is inferior to the two former, except for fattening animals.

The *azotized* elements of food, so called from containing azote, or nitrogen, are fibrin, casein, and albumen; they go to the repair of muscles, membranes, &c., which, in the active state of the body, are being perpetually consumed. Seeds and meats contain most of these principles; the former from 10 to 20 per cent., and lean meat 23 to 25 per cent. The richest seeds are beans, pease, wheat, barley, oats, rye, corn. This kind of food is most serviceable for draught animals and such as are used for strength and fleetness. For the comparative values, see the table in article *Fodders*. They are the only class capable of sustaining life by themselves.

The *non-azotized* contain no nitrogen. Starch, sugar, and gum are the principal of these; they are, by digestion, conveyed into the system, and changed so as to produce the heat which maintains life. Exposure to cold calls for a greater consumption of these principles than in a warm situation. Potatoes, beets, carrots, and roots generally excel in these principles, but no vegetable fodder is deficient in them. These cannot alone sustain life.

Fatty, or oleaginous food, adds fat to the body, which, in sickness and other circumstances, also contributes to the maintenance of animal heat. They are incapable of sustaining life. See *Fattening.*

The food usually consumed is a mixture of these in different proportions; thus, corn meal consists of 9 per cent. oil, 12 azotized principles, 50 non-azotized, the rest being water, husk, and saline matter; but the true value of any food is directly as tho nitrogen principles it contains. See *Fodders.*

Besides these substances, others are in less measure useful as food, viz.: salt, which assists digestion; jelly, or gelatin, which repairs waste in the cellular tissue; bone earth (as it exists in the food), which repairs the waste of the bones. Vinegar, alcohol, the juices of acid fruits, are also food of the non-azotized kind.

In perfect digestion, these varieties of food are taken up into the system, and the husk, certain useless salts, and water rejected; but it often occurs that the proportion of fat or starchy matters is so great, that much is rejected, unaltered, by the bowels.

The amount of food necessary to maintain an animal in ordinary exercise is rather less than two per cent. of the weight in hay, or its equivalent. See *Feed.* A man requires 45 ounces of wheat bread, or 14 of beef or mutton, daily, to maintain strength. An ox of 1000 pounds requires 20 pounds of hay, or the following equivalents:

120 lbs. of turnips,	17 lbs. of clover hay,
115 " straw,	12 " barley,
75 " carrots,	10 " oats,
67 " potatoes,	5 " beans.

The time of feeding should be regular: an hour allowed working animals to digest, water given afterward, and changes in the food made occasionally, but not suddenly, especially to green fodders.

FOOD OF PLANTS. Plants require water, carbonic acid gas, oxygen, ammonia, or other compounds containing nitrogen and saline matters; these they derive partly from the air and soil. See *these bodies.*

FOOT. A measure of 12 inches. Horse's foot. See *Horse* and *Shoeing.*

FORAGE. Provender, fodder.

FORAMEN. In anatomy, a hole or perforation through a bone.

FORCE. Anything that produces motion or pressure. *Mechanical* forces are those which produce palpable movements, as gravitation, the descent of weights upon bodies, &c. *Chemical* forces are those producing molecular movements, which are only perceptible by their effects; they are heat, light, tithonicity, electricity; these, however, occasionally give rise to more extensive movements.

FORCEPS. Instruments acting in the same way as pincers.

FORCING. In horticulture, forwarding the growth of plants, fruits, &c.; conducted in glazed houses, pits, frames, or in cellars for mushrooms, celery, endive, &c. Heat is one great essential; but light and air are also of the first importance to success, except with mushrooms, or in blanching. Forcing houses and frames, therefore, face the south, to receive most light; but during very cold weather the sudden action of the sun's heat is to be guarded against if there be the least frost within the house; hence, in green-houses for vines and fruits, it is common to cover the glass with matting during the depth of winter, to protect the trees from sudden heat.

FORCING PITS. Pits of brick, masonry, or wood sunk in the earth to contain the fermenting materials to produce bottom heat; they are used like frames, and in every respect resemble them in effect. The following is a description of the pit of one of the English gardens: "It is four feet deep within; the lowest ten inches of solid brick-work sunk in the earth; the remainder is a flue, three inches wide in the clear, carried entirely round the pit; the inner wall of which, forming the sides of the pit, is four-inch work, well bedded in mortar, and pointed, to prevent the steam penetrating; the outer wall of the flue is also four-inch, but openwork, to admit the steam and that of dung coatings into the flue, the top of which is rendered tight by a covering of tiles, &c. The frame rests on the external wall of the flue. The cavity of the pit, which is kept dry by means of drains, is nine feet two inches long, two feet eight inches wide, and four feet deep. It is filled with broken bricks to within eighteen inches of the top; then a foot of short cold dung, six inches of very rotten dung, trod down so as to admit half an inch depth of coal ashes, for preventing the intrusion of any worms that may be in the dung, complete the structure." See *Frame*.

FORCING PUMP. See *Pump*.

FOREST. A natural collection of trees. The principal trees are mentioned under their respective heads.

FOREST FLIES. Flies of the genus *Hippobosca*.

FORFICULA. The genus of insects to which the *earwig* belongs.

FORGE. "The workshop in which iron is hammered and shaped by the aid of heat. The term is generally applied to the places in which these operations are carried on upon the comparatively small scale; the great workshops in which iron is made malleable for general purposes being called *shingling mills*. A common forge consists of the hearth or fire-place, which is merely a cavity in masonry or brick-work well lined with fine clay or brick, upon which the ignited fuel is placed, and upon the back or side of which a powerful blast of air is driven in through the nozzle of a double-blasted bellows, which, in a common forge, is generally worked by a hand lever. Forges are sometimes constructed so as to be portable, when the bellows is most conveniently placed under the hearth: these are used in ships, and for various jobs on railways, &c."—(*Brande.*)

FORK. The *dung* and *digging fork* is in the form of a spade, with three or more flat prongs: it is employed in loose soils much more expeditiously than the spade in garden tillage. The *hay*, or pitch-fork, for turning hay, grass, or manure, is furnished with a long handle and two roundish teeth: sometimes a forked branch is used.

FORMATION. In geology, a group of deposites or strata apparently referable to a common origin or period.

FORMICA. The genus of ants, now the type of a tribe, the *Formicidæ*.

FORMIC ACID. The fluid ejected by ants when irritated contains this acid. The acid is formed by distilling tartaric acid with sulphuric acid and peroxide of manganese, and consists of $C_2\ HO_3+HO$. It is highly corrosive, acid, and of a peculiar odour; combines with bases to form *formiates*, which are very soluble. Formic acid contains a compound radical *formyl* (C_2 H).

FORMULA. In chemistry, the expression, by symbols, of the composition of any substance, as (EO, FOO_3) for *formic ether*.

FOSSA. In zoology, a depression on a bone.

FOSSIL. A part or the whole of any animal or plant imbedded in the earth, and more or less converted into stony matter.

FOSSORES. A group of hymenopterous insects, which dig or excavate cells in wood or earth to deposite their eggs.

FOSSORIAL (from *fodio*, *I dig*). Animals which dig their holes, as moles.

FOUNDATION. In architecture, the lower part of a wall, on which the wall is raised, and always of much greater thickness than such wall. A practice has lately been introduced of laying foundations on a bed of what is called *concrete*, which is a mixture of rough, small stones or large gravel stones with sand and stone, lime and water, with just enough of the lime to act as a cementitious medium with the best effect. See *Concrete*.

FOUNTAIN. A jet of water or fluid. The simplest way of forming a fountain is to conduct water by a small pipe from a higher elevation, where a tank or other reservoir exists; the open end of the tube below being made fine, the fluid is driven out with a pressure proportionate to the height of the reservoir, and, springing into the air, produces a fountain. Groups of statuary are beautifully displayed in fountains.

FOVEATUS, FOVEATE. Having a depression or pit: applied to the nectary of flowers.

FOVILLA. The yellow fluid contained in pollen.

FOWL. See *Poultry*.

FOX. *Canis vulpes*, Lin. The destruction committed by this animal and his great address in escaping have tasked the farmer's wits to destroy him. Good dogs are unquestionably the best remedy; but traps of all kinds, baited with flesh, are also extensively employed. The fox is led to these by trailing the entrails of a sheep or hog from his retreats to the trap. In the same way, the trail may be made to a tree, and the garbage left, the farmer ascending a tree in the neighbourhood, and waiting with a gun to shoot the fox. A large trap, like the old rat trap, may be fixed in the grass of a field, well hidden, and baited with a fowl.

FOX EVIL. A disease in which the hair falls out.

FOXGLOVE. *Digitalis purpurea*. An exotic biennial plant, with handsome flowers, of great value in medicine as a sedative and diuretic. It is extremely poisonous, but is cultivated with great care in drills eighteen inches apart. The plants should be kept free from weeds, cultivated in a dry soil, and freely exposed to the sun. The leaves are collected when full grown, in the second year, and just before flowering; they should be dried by exposure to the sun, and put up in tinned vessels. The leaves only are valuable.

FOXTAIL GRASS. Grasses of the genus *Pennisetum*, formerly *Setaria*. The most common (*P. glaucum*) is the coarse grass that springs up in stubble. None of them, except *P. Germanicum*, Bengal grass, is worth cultivation, and this is very inferior to the ordinary plants. It is an annual, sown in spring, and grows from two to four feet high with the flower stems.

FOXY. Sour or harsh.

FRACTURE. In farriery, the breakage of a bone in the body. Fractures are called *simple* when the bone is broken without tearing the muscles and passing through the skin, and compound in the latter case. The treatment requires care and attention. The broken ends of the bones are first to be nicely brought together by the surgeon, and then bound by splints. The splints are usually slabs of wood of a proper length and width to fit the limb, or stiff pasteboard soaked until it bends freely, and adjusted to the limb; the splint is bound on by a long riband of cotton. Splints should be sufficiently long to reach to the joints above and below the fracture, to restrain their motion. The animal should be bled if feverish, and kept low. It is sometimes necessary to suspend them in the stable, by passing a stout cloth under the body, and fastening its ends to the upper frame-work of the stable. In from three to five weeks the bones are usually reunited.

FRACTURE. In mineralogy, the appearance of a broken mineral which is not crystalline. It is termed resinous, choncoidal, vitreous, earthy, &c., according as it resembles that of resin, a shell, glass, or earth.

FRACTURES IN TREES. When they occur in the smaller branches, from excess of fruit, they readily unite by propping up to the natural position, if the accident occurs before the fall; but when the part has a considerable diameter, four to six inches, it is best to prune it, and cover the wound with coal tar or grafting clay.

FRÆNUM (from *frænum, a bridle.*) A membranous fold, which binds down one part of the body to another, especially the tongue to the mouth.

FRAGARIA. The generic name of the strawberry.

FRAME. In horticulture, the arrangement in which forcing is usually performed. A frame may be made of stout planks, the back one being two feet deep, the front fifteen inches, and the sides sloped; the width across may be six feet, and the length divided into partitions every three feet; over each partition a window or sash, capable of being more or less withdrawn, is placed. These frames are set upon the hot-beds of fermenting matters, and seedlings, melons, &c., raised in them.

The heating material, or hot-bed, may be set up on the ground, or in a shallow pit of two feet depth. The advantage of the former is that, as the heat diminishes, the old dung can be cut down and removed, being replaced by fresh, which supplies new heat, and thus the temperature can be kept up for a long time. A common bed for early vegetables is made by laying down twenty inches to two feet of fresh horse dung, and covering with six to eight inches of fine mould, tan, or compost, putting down the sashes of the frame, and allowing the steam to pass off for three days; opening the frame, stirring the soil, and sowing the seeds in drills, or broad-cast. The frame is subsequently to be opened or kept shut, according to the hardiness of the young plants. Beds made early in the season will require a greater depth of fermenting matter. During cold nights, cover the frames with matting, that no frost may penetrate. It is common to sink small thumb pots, in part, into the hot-bed, instead of sowing the seed on mould.

A cold frame is no more than the foregoing sash placed over a spot of well-tilled, rich soil, which it protects by the glass. It should be exposed to the southwest. Hot-beds and frames should always be placed over a well-drained spot.

FRAMING. The rough timber-work of a house.

FRANKLINIA. *Gordonia pubescens.* An ornamental tree of Georgia, somewhat resembling the dogwood when in flower.

FRAXINUS. The genus of the ash.

FREEMARTIN. A twin cow calf born with a male calf. If it resembles the bull it is barren, and is often barren when having the general appearance of a heifer.

FREEZING. Congelation. The conversion of water into ice. It takes place at 32° Fahrenheit, or below, and is much promoted by a sharp wind, which hastens evaporation. Water, in freezing, expands one ninth, and, if confined, will break open the stoutest vessels. Rocks and the soil are disintegrated by the freezing of water in them, which, expanding, tears the particles asunder. By freezing some mixtures or solutions, the watery parts may be, in some measure, separated, and the spirituous left untouched. See *Frost.*

FRENCH BEANS. See *Beans.*

FRENCH BERRIES. *Berries of Avignon.* The green fruit of the *Rhamnus infectorius*, a species of buckthorn, cultivated in France as a yellow dyeing material. It requires a southern climate, and in other respects does not differ from the buckthorn. It may be propagated by cuttings or seeds. The Persian berries are the finest for colouring.

FRENCH CLOVER. Lucern.

FRET, or FRETTE. In architecture, a species of ornament consisting of one or more small fillets. The section of the channels between the fillets is rectangular. The subjoined

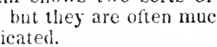


diagram shows two sorts of simple frets; but they are often much more complicated.

FRIABLE. Powdery, mealy, or readily broken into a powder.

FRICTION. The resistance offered to motion by a rough surface. In mechanics, it is divided into *sliding*, *rolling*, and *pivot* friction. Of these, the amount of friction with the same weight is twelve to twenty times greater in sliding than rolling, and is intermediate in pivot friction. Friction is diminished by polish, by reduction of weight, by causing the surfaces to be of dissimilar substances, as metal or wood, and by applying grease in sliding and pivot friction, but not in rolling friction.

Whenever it is possible to convert a sliding or pivot motion into a rolling one, much is gained; hence the arrangement of friction wheels, which consist of two or more wheels, supporting a pivot or axle, and which, by turning, produce a rolling instead of a pivot friction. Friction wheels have been recently introduced into carriage axles; the axis, instead of playing in the box, is surrounded with small, loose rollers, which revolve with it, reducing the friction to a remarkable extent.

Rigidity of cordage is also productive, like all kinds of friction, of loss of power, and is to be guarded against by using flexible ropes. The amount of friction depends, in a great measure, on the diameter of the wheel over which it passes, the extent of rope in contact, and its tension. When there is more than one fold, it becomes enormous, so as to be used as a mechanical means for stopping boats, &c.

FRIEZE. In architecture, the central portion of the entablature between the architrave and cornice. It is plain in the Tuscan, but adorned in other styles.

FRIGID ZONE. The space above 76½ degrees of north or south latitude. It is scarcely occupied by any plants but a few lichens.

FRINGE-TREE. *Chionanthus Virginica.* A beautiful ornamental tree, growing wild as far north as Delaware, and bearing white flowers in May.

FRINGILLIDÆ (from *fringilla, a chaffinch.*) A tribe of birds, of the Passerine family, with stout, conical bills (*conirostres*), including the linnets, canaries, finches, all of which are devourers of grain.

FROGS. Amphibious animals, of the genus *Rana.* The common species (*R. temporaria* and *esculenta*) are, for the most part, insectivorous. They should not be destroyed by the gardener, except when in great numbers, as they clear his garden of slugs, snails, and other small pests. The green frog (*esculenta*) is a great delicacy with some: the flesh of the hind leg is the part eaten.

FROG OF THE HORSE. A triangular portion of horn projecting from the sole almost on a level with the crust, and defending a soft and elastic substance called the *sensible frog.* The sensible frog occupies the whole of the back part of the foot, above the horny frog and between the cartilages.

FROG HOPPERS. FROG SPITTLE. CUCKOO SPITTLE. Small insects (*Cercopididæ*) which inhabit the twigs and branches of plants, from which they extract so much juice that the place on which they are collected appears covered with spittle.

FROND. The leaves of ferns are so called.

FRONTAL. In anatomy, appertaining to the forehead.

FRONTLET. In ornithology, the part of the head next the bill, usually covered with bristles.

FROST. Correctly speaking, frost is ice produced by radiation. Under the article *Dew* it has been stated that in bright, clear, calm nights, all objects exposed to the air become cooled by radiation into the sky; if the temperature falls to 32°, then frost, or pellicles of ice, are produced instead of *dew.* The word is also used in common to express freezing; but, in the latter case, the air is usually at or below 32° Fahrenheit, whereas night frosts often occur in the spring and fall when the air is 40° to 50° Fahrenheit. Frosts fall earlier on dark, rough lands than those of a light colour and indurated condition.

Frosts are most injurious to plants at 50° Fahrenheit, in full vigour of growth; hence a slight frost in spring usually destroys expanding buds and the young shoots of vegetables. It may act in a variety of ways, but commonly by freezing the sap of the leaves, which produces a disorganization of its tissues. Frosts by radiation occur sooner in elevated situations, at a distance from lakes or rivers, than in valleys that are kept moist. Whatever intercepts the clearness of the sky diminishes or arrests frosts; thus, clouds, a large quantity of vapour in the air, smoke, or matting, straw, glass, boards, &c. Hence, gardeners cover tender plants with leaves, straw, pine brushwood, or protect them with mats or glass; in such cases, the radiation is from the mats, &c., and not from the plants. Watering plants abundantly at nightfall, when the evening appears clear and frost may be apprehended, is often efficacious; watering before sunrise, after a slight frost, is also valuable, for the vapour of water, in both cases, acts as a covering to the vegetation; in the evening it diminishes radiation; in the morning it gently warms and thaws the leaves before the destructive action of the sun can take place. Trees are often preserved by twining a quantity of rope among their branches and allowing the ends to dip in water. On a larger scale, the Indians of Cusco used to burn large quantities of moist straw and leaves at sunset when a frost was apprehended, and thus, by obscuring the sky, hinder radiation. During the winter a coating of snow is a remarkable protection to a crop, maintaining it at a regular temperature, while the exposed surface would have been much injured by severe frosts. A bed of snow, eight inches thick, frequently measures 10° Fahrenheit at the surface and 32° Fahrenheit at the earth, and, being a very bad conductor of heat, changes its lower temperature very slowly.

Flooding meadows to such a depth that the earth may not be frozen is one of the most certain and effective means of saving grass and advancing it in maturity for the next spring, the water being withdrawn when the weather has become mild and free from frost; lands over which fogs lie long are also well protected from early frosts. Exposure has also much influence on the early occurrence of frosts; lands which receive the least sun and are exposed to chilling winds being visited much sooner than those looking to the south and sheltered.

The night frosts produced by radiation are very different from the coldness of the air in winter. The cold of winter does not act precisely like early frosts; valleys are sooner affected than hillsides unless they contain water, and this is supposed by Lindley to be produced by the descent of cold air from above into them, but is also due to the lesser duration of sunshine. During our winters the sun usually retains much power, so as to produce thawing in places where his direct beams fall; this effect taking place suddenly, and often upon trees or vegetable structures, is very injurious, so that delicate trees are often destroyed in orchards facing the southeast from this cause, especially in the spring. Sudden thawing, whether taking place on a leaf, tree, or root, is much more injurious than freezing; for the expansion produced in the gases of the plant causes them to rupture the cells and become mixed with the fluids, thus commencing decomposition. It is a well-known fact that potatoes, &c., may be kept frozen for a year or more without injury, if they be thawed gradually by immersion in spring water; but if they be exposed to a hot sun, or thrown into hot water, they become disorganized, and rot at once. Hence the policy of the gardener and orchardist is to plant orchards and expose early vegetables and products in such a manner that changes from heat to cold may be gradual, and not sudden. The retardation of flowering in a northern situation, in fruit-trees, is amply compensated by the greater certainty, so that a northwestern position is now preferred for an orchard. Gardens in which annual vegetables only are raised should have a southeastern exposure.

The preservation of fruits, roots, &c., depends more on placing them out of the reach of sudden changes of temperature than keeping them free from frost; for if kept frozen, they remain sound all the winter, and are to be thawed slowly, by first immersing in spring water (at 40° Fahrenheit), in the shade; but in these cases the freezing must have been gradual, and not sudden. See *Barrow*.

The spewing of lands, or efflorescence of ice which occurs on stiff soils during winter, is produced by the thawing of an inch or two of the surface during the winter, and a sudden frost subsequently: in this way the water confined in the thawed part being converted into ice, and expanding, cannot find passage downward, and so is thrown up, along with a portion of earth, above the surface. It does not occur to any extent on well-drained, warm soils, and is frequently injurious by casting out the seeds of wheat and winter grains. Drainage, and the use of the strong-rooted wheats, with early sowing, are the preventives.

The spewing and disintegrating effects of frost on lands are of eminent service, when they are fallow, in pulverizing the soil and preparing it for the spring crop. Exposing stiff lands to frost by ploughing in the fall is almost an essential condition of good tillage: it is also of great service in destroying the roots of weeds and grubs of worms.

Porous sandstone rocks are often much disintegrated by the action of freezing water, driven into their pores by rains.

FRUCTIFICATION. The part of plants destined to produce fruit or sporules.

FRUIT. In botany, the ovarium arrived at maturity. It is called *fleshy* or *indehiscent* when pulpy, and *dehiscent* when dry. The divisions within the fruit are termed carpels. Commonly it means a fleshy fruit only. Fruits are rather laxative.

FRUITING. Bearing fruit.

FRUIT INSECTS. See *the fruits*, as *Apple*, *Plum*, &c.

FRUMENTACEOUS. Resembling wheat, or made of wheat.

FRUSTRUM. The part of a solid cone left after cutting off the top.

FRUTESCENT. Woody.

FRUTEX. A shrub, a small tree, the branches of which start from the soil without any regular trunk.

FUCUS. A genus of sea-weeds. *Fucoid*, like a sea-weed.

FUEL. Substances used to obtain heat are called fuel. The heat produced by burning a given weight of fuel increases with the dryness, solidity, and amount of carbon. The immediate effect depends upon the rapidity of burning, which is hastened by a rapid draught of air, long chimney, and other means. One pound of bituminous coal will raise 60 lbs. of water from 32° to 212° Fahrenheit. The proportionate values of other kinds of fuel, measured by the same effect, are:

Dry wood	35	pounds	of water.
Common wood	26	"	"
Charcoal	73	"	"
Pit coal	60	"	"
Coke	65	"	"
Peat	30	"	"
Oil, tallow	78	"	"
Coal gas	76	"	"

FULCRUM. The point about which a lever moves. A prop.

FULGORA. A genus of insects, the fore part of the head of which is produced into a large hollow receptacle. Some are supposed to emit a brilliant light.

FULGURATION. In chemistry, the sudden brilliancy emitted by gold and silver as it cools from fusion before the blowpipe.

FULIGINOUS (from *fuligo*, *soot*). Sooty, of the colour or appearance of soot.

FULLERS' EARTH. A clayey mineral, readily miscible with water, used for fulling or cleaning cloth of grease.

FULLERS' TEASEL. See *Teasel*.

FUMIGATION. The exposure of substances, or the air of a room, to certain vapours, to counteract a disease or to purify. Warm vinegar is commonly employed; thorough ventilation is also necessary. The chlorine given off from chloride of lime, or generated by adding muriatic acid to black oxide of manganese, is the best fumigating substance. It has the power of neutralizing the most disagreeable odours, but is injurious to health, and must only be used in vacant apartments.

FUMITORY. *Fumaria officinalis.* Cultivated chiefly as a flower: cattle will eat the herbage.

FUNDI, FUNDUNGI. *Paspalum exile.* Hungary rice. A gramineous annual plant growing 18 inches high, and producing an abundance of minute seeds, which are used in Africa as rice. It is sown on dry natural soils in May, and reaped in September, the seeds being readily thrashed out.

FUNGI. The race of mushrooms, toad-stools, blight, rust, &c. They consist of cells only, and produce spores, or seeds, without flowers. Fungi grow, for the most part, on dead or living vegetable matters. Those fungi are poisonous that have a disagreeable narcotic smell. The most important will be found in this book. The word *fungoid*, like a mushroom, is a derivative.

FUNGICOLA. A genus of coleopterous insects dwelling in mushrooms.

FUNGIN. The white, tasteless solid remaining after mushrooms have been fully digested in alcohol and in water. It is an azotized matter nearly resembling fibrin, and very nutritious.

FUNGUS. A mushroom. In farriery, proud flesh, a fleshy excrescence growing out of a sore, or about the edges of an ulcer. It should be reduced by the use of caustic. Lunar caustic or red precipitate is the best application.

FUNICULUS. In anatomy, the cord which attaches the fœtus to the after-birth, or placenta, also called the umbilical cord. The thread by which the seed is fastened to the carpel.

FUNNEL. A trumpet-shaped vessel open at both ends, used to transfer fluids, and especially in chemistry, to lay filters upon.

FUNNEL-SHAPED. Infundibuli form, a term descriptive of the figure of some flowers.

FUR. The skins of animals well covered with hair. The unprepared dry skins are called *peltries.*

FURFURACEOUS (from *furfur, bran*). Resembling bran.

FURLONG. The eighth of a mile: 40 poles.

FURNACE. In chemistry, a small, moveable vessel of plumbago or fire clay, in which charcoal may be burned for the purpose of distillations, heating tubes, &c. It is usually provided with several parts for the convenience of carrying on the several processes and obtaining a high heat.

FURRIERS' WASTE. The clippings of skins: as a manure it is similar to old rags.

FURUNCULUS. A boil.

FURROW. The movement of the earth produced by the action of a plough: *furrow slice* is the slip of earth turned over.

FURROW, WATER. The furrow made in ploughed lands to let off surface water.

FURZE. Shrubs of the genus *Ulex*, the most common of which, *U. Europeus*, is also called gorse and whin. It is a hardy, leguminous evergreen, growing abundantly on poor lands, and made use of for hedging and coarse fodder in Europe. It grows rapidly, so that it can be cut every four years for fuel, and is so far nutritious that horses are often maintained on furze only; but, considering the abundance of excellent fodder plants we possess, the introduction of furze is scarcely worthy of thought. As a fencing material, it is objectionable, from the room it requires, but the prickles with which it is covered make it a sure defence.

FUSIFORM. Spindle-shaped, tapering to each end; a descriptive term in botany.

FUSION. Melting. In fusion, a

great amount of heat becomes latent. The point of fusion differs extremely in metals, from six hundred to several thousand degrees of Fahrenheit.

FUSTET. The wood of the *Rhus cotinus*. Young fustic.

FUSTIC. The wood of the *Morus tinctoria*, a species of mulberry. It yields a dingy, yellow orange dye to water; it imparts permanent colours to wool when mordanted with alum or a solution of tin. It mixes well with indigo and Saxon blue, forming a green. With copperas it forms olives and browns. Five to six parts of the old wood give a lemon colour to 16 of cloth. The colour is less altered by acids than other yellows, but it is inferior in brightness to *weld*. The fustic-tree grows naturally in the West Indies and America.

FUSTIC, YOUNG. A name for the *Rhus cotinus*, or Italian sumac, which yields a greenish-yellow dye, used in mixtures.

G.

GABLE. The triangular piece of wall at the ends of a house, immediately under the roof.

GADFLY. BREEZE. Dipterous insects of the genus *Æstrus*. These insects nearly resemble the *bot flies*; they deposite their eggs under the skin of animals, which they pierce, giving considerable pain. The yellow-eyed forest flies that infest horses in July are of the genus *Crysops*.

GAGE, GAUGE. In physics, an instrument to measure any result, as *wind-gage*, *rain-gage*.

GALACTOPOIETIC (from γαλα, *milk*, and ποιεω, *I make*). Substances which increase the flow of milk. The affixes *gala* and *galacto* indicate milk or milky; as *galactometer*. See *Lactometer*.

GALANGAL. *Kæmpferia galanga*. A root formerly used in medicine, and imported from China.

GALBANUM. *Galbanum officinale*. An umbelliferous herb of Africa. A fetid gum resin exudes spontaneously from it of antispasmodic properties.

GALBULA. A genus of climbing birds like the kingfishers; they live in wet forests, and are insectivorous.

GALBULUS. A fruit of a rounded form, but with an internal conical arrangement of the carpels; as that of the savine, junipers, and yew.

GALEATE. Helmet-shaped. In botany the term is applied to the upper arched lip of personate flowers.

GALENA. Sulphuret of lead. An abundant ore of a bright metallic colour and cubical form.

GALERUCA. A genus of coleopterous insects, the type of the *Galerucidæ*, including the *Haltica*. They are vegetable feeders in the perfect and larva state. The yellow-striped squash beetle (*G. vitata*) is of this genus.

GALIUM. A genus of plants, of which *cleavers* (*G. aparine*) is a species. *G. verum* is used as rennet to curdle milk in cheese-making. The family of plants of which it is the type (*Galiaceæ*) includes madder and spurry. The whole family is nutritious.

GALL. Bile. Ox gall is of great service for removing oil spots from cloth and carpets, and for fastening and brightening colours. The *gall-bladder* is the small sack situated under the liver, and contains gall. It communicates with the small intestines by the *biliary duct*. *Gall stones* are concretions formed in this bladder, which consist, for the most part, of hardened bile or of cholesterine.

GALLIC ACID. A crystalline, inodorous substance, slightly soluble and styptic. It precipitates per salts of iron of a black colour. It is formed by exposing a solution of tannic acid to air, by which oxygen is absorbed: formula $C_7\ H_3\ O_5$. Gallic acid is of little importance, and seldom occurs naturally in plants.

GALLED. Naked, bare. Excoriations on the skin of animals are often called galls and galled spots.

GALL-NUTS. Excrescences produced on the leaves and leaf stalks of the *Quercus infectoria* by an insect (*cynips*). They are best from the Levant, of a dark colour, heavy, and of the size of a bullet; but other galls, with a prickly surface, are formed on the *Q. cerris*, &c.

Gall-nuts contain tannic acid, yellow colouring matter, and gallic acid. The decoction produces a variety of coloured precipitates, with reagents; with solution of tin, a yellow; alum, a yellow gray; acetate of copper, a chocolate; red sulphate of iron, a blue black. They are used in making ink and dyeing. See *Tannin.*

GALLINACEOUS. Birds resembling the domestic cock; as turkeys, pheasants, pigeons.

GALLON. The imperial measure contains 277·274 inches, or 10 pounds of distilled water at 62° Fahrenheit. It is equal to four quarts, or eight pints. The old wine gallon contained 231 cubic inches; the beer gallon, 282 cubic inches. Each of these standards is used in different states. The half peck is a gallon in dry measure.

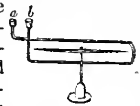
GALLOWAY. A pony of 13 to 14 hands. Originally, a small breed of horses. A variety of Scotch cattle.

GALLOWS OF A PLOUGH. A part of the plough head.

GALLS. In farriery, wounds produced by the friction of harness. The little tumours formed under saddles are called warbles. Washing the galled places with a solution of sugar of lead, or keeping them clean with a plaster of common ointment, or dressing with Turner's cerate, and allowing no farther pressure on the part until it is healed, are the proper remedies. *Wind-galls* are little tumours about the heels of horses over-driven.

GALVANISM. That form of electricity produced by the chemical action of one body on another. A simple galvanic circle or arrangement consists of a metal subject to the action of the fluid, and a second not influenced thereby, an exciting fluid, with wires, called poles, proceeding from each metal. The most common materials are zinc, copper, and sulphuric acid diluted with twelve parts water. The acid acts on the zinc only, and the electricity so produced is conveyed along the wires or poles. No galvanism passes until the poles are brought in contact; any fluid or body between them, which is an imperfect conductor, is heated or decomposed by the current. A galvanic pile consists of a series of the two metals so arranged that the coppers and zincs touch in pairs: two poles at the extremities discharge the electricity produced by the whole apparatus. Other metals and fluids are used, as well as peculiar arrangements contrived for the production of a continuous current. For the application of galvanism to agriculture, see *Electricity.* There are two conditions of the galvanic fluid referred to by chemists, *i. e.*, *quantity* and *tension.* Quantity is produced by using very large surfaces of metal and strong exciting fluids; tension by employing numerous pairs.

GALVANOMETER. "An instrument for ascertaining the presence of a current of electricity, especially galvanic or voltaic electricity, by the deviation which it occasions in the magnetic needle. The simplest form of galvanometer is a magnetic needle poised upon a point, and surrounded by one or more coils of copper wire, covered with silk, the ends, *a* and *b*, being either left free, or terminating in two small copper cups containing mercury, for the convenience of communication with the source of electricity. When this needle is placed parallel to the coil, and in the magnetic meridian (as represented in the margin), it immediately deviates when the electric current passes through the coil; and the deviation is either to the east or the west, according to the direction of the current."—(*Brande.*)



GAMA GRASS. *Tripsacum dactyloides.* A coarse, perennial, indigenous southern grass, growing to four or five feet. It is very productive, and may be propagated by seeds or roots. The cultivation is scarcely thought advantageous.

GAMBOGE. The dry juice of the *Stalagmites Cambogioides* and other East Indian trees. This colour is a gum resin; it is poisonous, a drastic purge and emetic. Water-colour painters employ it extensively.

GANGLION (from γαγγλιον, *a knot*). A natural swelling or enlargement on a nerve. A painful tumour formed on the sheath of a tendon.

GANGRENE (from γραειν, *to feed upon*). Mortification. An ulcer which produces the death of the part; this result is usually the consequence of very feeble health. Nutritious stimulants are to be administered.

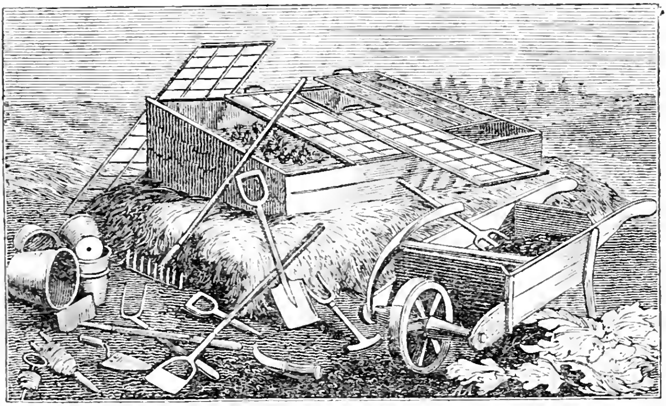
GANGRENE IN TREES. A blackening of the inner bark, variously produced, leading to the death of the tree unless cut below the disease.

GANGUE. The mineral in which ores are imbedded, also termed the *matrix*.

GAPE. In ornithology, the opening between the mandibles.

GAPES. A disease in young chickens and turkeys attended with much gaping. See *Poultry*.

GARDEN. The enclosure allotted to the cultivation of culinary plants. Its great productiveness is a lesson in favour of deep spade tillage. Those parts devoted to annuals should have a southern exposure; but trees and perennials require a sheltered or northwestern aspect. Plants which flower should be planted far apart. The soil must be well drained. Walls and trellises in gardens are of the first importance to shelter vegetables and allow choice trees to be trained.



GARDEN HUSBANDRY. "This is a branch of horticulture, the object of which is to raise fruits, vegetables, and seeds for profit on a smaller extent of ground than is usually occupied for the purpose of agriculture.

"The best examples of this kind of industry are found among the market-gardeners near populous towns, particularly London, Paris, and Amsterdam. By the application of much manual labour and an abundant supply of manure, they accelerate the growth of vegetables, and produce them more abundantly than where manure is not so easily obtained, or where there is not so large a demand for the produce.

"The gardeners near Paris, some of whom have gardens within the outer walls of the city, are called *Maraichers*, from the situation of their gardens in a low district which was formerly a marsh (*marais*). The industry of this laborious class is proverbial. Their whole life is devoted to their gardens. They work the whole day in the greatest heat of the sun, and long before the rest of the inhabitants awake they are on the way to the market with their produce. The soil in which they raise their vegetables is naturally a poor sand, but by constant manuring it has been converted into a very rich mould, abounding in humus. From its porous nature and the frequent recurrence of dry summers, it would produce little without constant and abundant watering. The raising of water from numerous wells dispersed through the grounds, and conveying it to the growing plants, is the most laborious part of the work: during the whole summer this labour is incessant. There are large stone cisterns in which the water is allowed to remain, that it may acquire the temperature of the air; and from these it is carried by pipes into various channels which intersect the garden in every direction. These gardeners divide the season into three periods. The first begins in October, when they sow lettuces in a hot-bed, which are pricked out a month after, and planted finally in a sheltered border about the end of January, the ground having been well dug and abundantly manured with very rotten dung taken from the hot-beds. At the same time, they sow radishes and leeks among the lettuces. The radishes are sold by the end of March, the lettuces in May, and the leeks in June. This completes the first season. The ground is now dug again, and manured with fresh long stable-dung, mixed with the earth of which the hot-beds were formed; in this they plant alternate rows of endive or scarolles (both varieties of chicory), and of cucumbers, which produce gherkins for pickling and sauces. The endive is sold in July, and the small cucumbers continue to be gathered till September. In the third season, which is the shortest, another digging and dunging is given, after which they sow radishes and small winter-salad, of which the French have a great variety. Winter endive is also planted for blanching. From this statement it appears that the ground produces a constant succession of culinary vegetables, and that it is manured thrice in the year. The great object is to have a rapid succession, and to allow no plant to occupy the ground long. Cabbages, cauliflowers, asparagus, artichokes, and other vegetables which remain a long time on the ground, are cultivated at a greater distance from Paris, where the land lets at a lower rate. These plants will bear to be carried to a greater distance than the delicate vegetables which are used chiefly in a raw state as salads. The only perennial plant in the gardens of the Maraichers is sorrel, of which there is a great consumption. This is continually dunged and watered to accelerate its growth, and is cut many times in the season. It must, however, be allowed that this forcing with manure and water, although it produces large and delicate fibres, does not give the flavour which belongs to vegetables grown in common earth, and which have had a more natural growth.

"The market-gardens near London are on a larger scale, and if they produce fewer salads and pot-herbs, they produce better and more substantial vegetables, and likewise a considerable quantity of fruit.

"The best soil is a moist alluvial loam deposited from repeated overflowings of the Thames, which are now prevented by banks or dikes; but an increased demand for vegetables has caused much inferior soils to be cultivated as gardens, and increased labour and manure have supplied the deficiency in natural fertility. The gardeners' year properly begins in autumn, when the land is dug, or, rather, trenched, and well manured. Various vegetables which will be required in winter are now sown, and especially those which are to produce plants to be set out in spring; spinach, onions, radishes, and winter salads are sown, and when the weather is severe, are protected by a slight covering of straw or mats. In February, the cauliflowers which have been raised in frames or under hand-glasses are planted out. The cabbage plants are pricked out. The radishes, onions, and salads go to market as soon as they are of sufficient size, and sugar-loaf cabbages succeed them. As the cauliflowers are taken off, they are succeeded by endive and celery, and the same is the case with the cabbages. Thus there is a constant succession of vegetables, without one moment's respite to the ground, which, in consequence of continual stirring and manuring, maintains its productive power. Deep trenching in some degree prevents that peculiar deterioration of the soil which would be the consequence of the frequent repetition of similar plants. This effect is most perceptible when the plants perfect their seed, which is seldom or never allowed to take place in market gardens; but great attention is paid to the species of plants which succeed each other on the same spot. The principle which experience and theory unite in establishing, is that of avoiding the too frequent recurrence of plants which belong to the same natural families. The greater variety cultivated in gardens, in comparison with the common produce on a farm, enables this principle to be fully acted upon. Those gardeners who overlook this, and repeatedly sow or plant the same kind of vegetables in the same spots, are soon aware of their error by the diminution of the produce, both in quantity and quality, and by various diseases which attack the plants, however abundant may be the food supplied to them or careful the tillage.

"The principle on which the gardens are cultivated is that of forcing vegetation by means of an abundant supply of dung, constant tillage, and occasional watering. The whole surface is converted into a species of hot-bed, and crop succeeds crop with a rapidity which is truly astonishing. Those vegetables which arrive at a marketable state in the least time are always the most profitable, and those also for which there is a constant demand at all times of the year. With an abundant supply of manure, the market gardeners have no fear of exhausting the soil, and dissimilar vegetables may grow together on the same ground. Trees bearing fruit may be planted in rows, especially those of the dwarf kind, and under them those vegetables which do not require much sun may be raised to advantage. Raspberries, gooseberries, and currants are planted in the rows between the trees. These rows being thirty or forty feet apart, leave ample room for vegetables; but in those gardens where the finest vegetables are raised, and particularly in those which are appropriated to the growth of seeds, no trees are permitted to shade the ground; even the hedges, if there are any, are kept low and clipped, that they may not give any shade, or harbour small birds.

"A garden should always be laid out in a regular form, with narrow parallel beds, and paths between them. One or more roads, of sufficient width to allow a cart to pass, should intersect these beds at right angles, for the convenience of bringing manure and taking off the produce. The beds should not be above six feet wide, so that a person may easily pull up weeds or gather the vegetables without treading upon the beds. The surface soil taken from the paths serves to raise the beds, and in retentive soils may carry off the superfluous water after sudden and violent rains. The whole ground should have been trenched two spits deep or more; and this trenching should be frequently repeated, to mix the upper with the under part of the soil, and distribute the decomposed dung throughout the whole depth. Thus in time a rich black mould will be produced, in which every kind of vegetable will grow most rapidly. For early plants, and those which are used in winter, and require to be protected from frost, narrow beds are made lying in a direction east and west, and sloping towards the south, witn the north side raised high, so that their surface forms an angle of twenty or thirty degrees with the horizon. This gives the plants a protection from the north winds, and exposes them more to the influence of the sun. In very frosty weather, these beds are covered with mats or loose straw. We do not mention frames covered with glass, as they belong to a higher kind of horticulture; but a moderate hot-bed made with fresh dung, and covered with mats laid over hoops, is indispensable for the raising of early vegetables. By these means radishes and various salads may be raised very early in the spring, and sometimes in mild winters, without any interruption during the whole year.

"An abundant supply of manure is indispensable in a market garden, and this can generally be obtained in large towns at a trifling expense. The neighbourhood of a town is therefore a necessary circumstance towards the production of the crop, as well as its sale. It would be impossible to make a sufficient quantity of manure by means of the horses which are employed to carry the produce to market, and the extent of land usually laid out in garden ground could not raise sufficient food for cattle without taking up a space which may be more profitably employed. The only animal which can be kept to advantage by a gardener is a pig. This animal will live well on the offal of vegetables, and the gardens of cottagers could not well be kept in a fertile state if it were not for the manure made by the pigs.

"The market gardeners about Amsterdam are mostly Jews, and the vegetables which they bring to market are similar to those of the London or Paris gardeners; but they excel particularly in raising cauliflowers, large white cabbages for making *saur-kraut*, French beans, cucumbers, and melons. They also excel in the forcing of early pease and beans, and in the general management of hotbeds.

"The profits of a garden near a large city, of the extent of 10 or 12 acres, are as great as that of a farm of ten times the extent cultivated in the best manner, without the help of purchased manure. But if manure can be obtained at a reasonable rate, as is often the case in great thoroughfares, where many horses are kept for public conveyances, although there be no immediate demand for vegetables, a garden may be very profitably cultivated, entirely for the purpose of raising seeds. The demand for seeds of all the most common productions of a garden, and especially of flowers, is very great, and the profit of those who retail them in small quantities is so great that they can afford a liberal price to those who raise them with proper care, so as to keep the varieties distinct.

"Many plans have been proposed for the distribution of the crops in a garden; but none of them are suited to every situation. Much depends on the nature of the soil, which may be better suited to one kind of produce than another, and also to the demand far any peculiar class of vegetables. New sorts may often be introduced with advantage. The raising of any useful plant with great care will often give a man a reputation, which makes it advantageous to him to confine himself to these principally, and raise them in the greatest perfection. An ingenious man will find out what is most for his own advantage; and, from the list of plants which may be cultivated for ornament or for use, a selection may be made which may be well suited to the situation of the ground and the circumstances of the grower. The practice of the market gardeners may be examined with advantage; and long experience, with the test of profit, will lay down better practical rules than the most plausible theories."

The implements necessary for garden tillage are displayed in the *figure;* the plough may be used to assist in trenching, and improved drills for sowing; but the spade, rake, and hoe are the principal tools; indeed, labour is the great essential in the garden.

"The application of the garden husbandry must be in the preparation of the soil by deep trenching and digging, carefully drilling or dibbling all the seeds in rows, stirring the soil between the growing plants, and keeping the ground clear of weeds by the hand and the hoe. These last are the most essential part of the cultivation. By daily attention to the progress of the plants, and continual assistance at critical periods, sometimes thinning out, and at other times transplanting to produce an equal crop, and treating every plant as if it were a rare plant in a garden, the ground may be made to produce more than double what the most attentive farmer could expect on a larger scale."

These short rules may be added for garden cultivation:

1. Regulate the distribution of your plants with respect to shade and sun. Ordinary standard trees should be on the north and west sides, near or against the wall or fence, so as not to shade too much from the sun.

2. Alternate the crops, and do not plant varieties together, lest the pollen should mix.

3. Plant immediately after preparing the soil.

4. Seeds and young plants require to be kept moist, and with light soil about them.

5. Stirring the earth about well-set plants is one of the most certain and rapid means of forwarding vegetables.

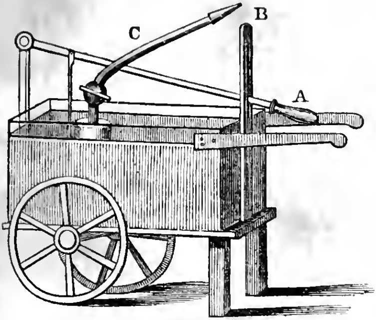
6. Trench the soil over sixteen or eighteen inches deep regularly every four or five years, taking a fifth part annually.

The following remarks from Judge Buel are concise, and well adapted to farmers:

"The month of May is an important one in the operations of the garden. If not already done, no time should be lost in sowing the seeds of onions, salads, early cabbage, pease, radishes, and in planting some early corn and potatoes. The beet, carrot, parsnip, and summer squash may also be sown. Cabbages for winter use may be sown in time from the 20th to the 30th. As soon as the soil and the season are warm enough to bring up corn, which here is generally from the 15th to the 20th, plant your melons, pumpkins, and cucumbers, though it will do equally well to plant the latter, for pickles, in the early part of June. The 15th will ordinarily do for Lima beans, which are the best of the bean family. Soak the seed of these in warm water a few hours, and cover them slightly when planted. My practice is to save this crop for winter use. They afford a great product. When frost is apprehended the beans are all picked, the unripe ones shelled and dried; and, if soaked before cooking, are nearly as good as when first gathered from the vines. Perennial products require very little care after they are once established. We will name of fruits, the strawberry, the currant, gooseberry, plum, pear, quince, grape, and, in situations where they will thrive, the apricot and peach. But of fruits we would have none but the best sorts, for the best are as cheap as the worst, are as easily cultivated, and are infinitely more healthy and grateful. These, if well selected, will give a succession of fruit from June to November, and in a preserved state during the year. Plants to begin with will cost from three to five dollars. They may be multiplied by grafting, budding, &c. The trees should be so arranged as to shade as little as possible the grounds that are to be tilled. Half a dozen roots of the pie-plant (rhubarb) will furnish abundant materials for pies and tarts, in no wise inferior to the gooseberry, from April to July, or until the fruit is sufficiently advanced to supply its place. These should be planted two feet apart in good soil. A bed of forty by three and a half feet will supply the table with delicious asparagus during a part of April, and the whole of May and June, if kept in good order. For this the ground should be dug deep and made rich.

"The annual products which go towards subsisting a family, and which are seldom produced but in the garden, are numerous, as the onion, beet, carrot, parsnip, cabbage, pease, beans, pot-herbs, salads, radishes, squash, cucumber, melon, &c. Some of these are in use most of the season, and most of them afford valuable winter stores."

GARDEN ENGINE. This is a small forcing pump, fixed in a box, and sustained on wheels. It is worked by the handle, A, and either used to direct a current of water by the jet, or hose, B, or to water vegeta-



bles with a rose screwed to the end of the pipe, C. The box is kept full of water.

GARGET. "In farriery, a disease in the udders of cows, arising from inflammation of the lymphatic glands. It is also a distemper incident to hogs, and which is known by their hanging down their heads, and carrying them on one side, moist eyes, staggering, and loss of appetite.

In order to remove the disease in cows, where the inflammation is great, the cow should be bled, a dose of physic administered, the udder well fomented, and the milk drawn gently but completely off, at least twice a day."—(*Youatt on Cattle.*)

GARLIC. The genus *Allium*, distinguished by a hot, fetid smell. The common cultivated kind is the *A. sativum:* it is propagated by setting the parted cloves in April, about six inches apart, clearing from weeds, and tying up the leaves with bass in June; in August they are fit to be taken up. Chives and rochambole are of this class of plants. Garlic is an expectorant in small doses.

GARNER. A granary.

GARNET. A common mineral, of a rich colour, containing silica, 42; alumina, 20; lime, 34; iron, 4. Some of the finest crystals are set as jewels. They are usually found in the primitive and transition rocks.

GAS. A general name for all elastic aeriform bodies not condensible by ordinary cold. The extraordinary elasticity of gases, the rapidity and regularity with which they expand by heat, and the manner in which they diffuse into one another, are their chief peculiarities. Some have been condensed into fluids and solids by powerful pressure; but oxygen, nitrogen, hydrogen, and some others resist all mechanical force. The imponderables, heat, light, and electricity, have, however, perfect control over the elastic condition of gases in the presence of chemical bodies with which they can combine. See *the particular gases.* Gases are readily absorbed by porous earths and bodies, especially by plants and charcoal.

GASHOUSE LIQUOR. The fluid which distils over in making gas from bituminous coal. It consists of water holding in solution carbonate, muriate, and sulphuret of ammonia, with impurities. One hundred gallons contain 25 pounds of these salts. This amount may be applied per acre, diluted with five times its bulk of water, over the growing crop. Experiments made in England on grass-lands are very favourable, it having occasionally trebled the yield. The value of the ammoniacal salts is increased by adding a little sulphuric acid to the liquor: the quantity should not be enough to impart a sour taste. The amount of ammoniacal salts in different specimens is subject to great fluctuation, and depends on the variety of coal used. The liquor may be added to the compost heap, or, after neutralizing it with sulphuric acid, evaporated nearly to dryness, and left to become dry by exposure to the air. The liquor is very noxious to insects.

GASHOUSE REFUSE. Besides ammoniacal liquor, a mixture of lime and water is used to purify the gas. The refuse lime is strongly impregnated with sulphur, and contains carbonate of lime also. It has been used with good effects as a manure in England. The dose should not exceed two bushels per acre when applied to a growing crop. Its chief value is as a poison to insects, and for their extermination it may be applied to a short fallow at the rate of ten bushels or more. A solution would be very serviceable to destroy caterpillars in the garden. It acts on plants in the same way as plaster of Paris, and is best adapted to turnips, cabbages, and leguminous crops. The quantities added in England are often as great as twelve cart-loads to the acre; but this is *monstrous*, and the persons applying it are obliged to wait some time before they plough the land, lest it should destroy the next crop. This refuse answers well in composts.

GASOMETER. A vessel to collect gas.

GAS TAR, or COAL TAR. This is a good black paint for rough work, especially if mixed with oils or grease by heating; it protects wood very efficiently from wet, and very nearly resembles common tar. It has been imperfectly used as a manure: the results are uncertain.

GASTRÆUM (from γαστηρ, *the belly*). In zoology, the whole under surface of an animal.

GASTRIC JUICE. The secretion of the stomach, which, by dissolving fibrin, albumen, casein, and nutritious matters, has the power of producing the *chyle*, which repairs the waste of the body. It contains pepsin, and is sometimes acid, at others alkaline.

GASTRITIS. Inflammation of the internal or mucous membrane of the stomach.

GATE. The most common defects of gates are,

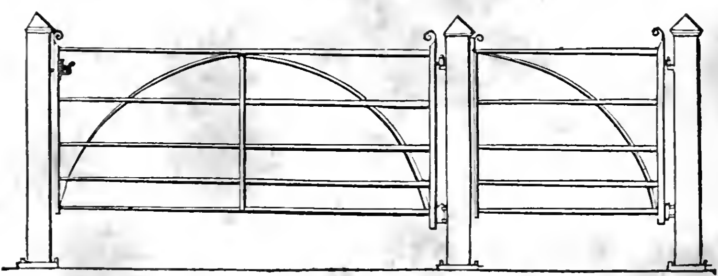
"1st. Insufficient height, so that horses and large cattle, when pushing against the gate, break it, however strong it is, as the top thereof comes in contact with that part of the chest of a horse where the collar goes, and without inconvenience he leans his weight against the opposing bar, which, if a few inches higher, presses against his neck and windpipe, and he makes no impression upon it.

"2d. They are generally hinge-bound, so that, in attempting to lift up the head, which is often required to be done, the ledges and braces are either pulled from the back head or broken therein; the person lifting the head having a nine feet leverage, which enables him to do this mischief.

"3d. The places of contact between the brace and the uprights and the ledges are broad, and it being impossible to keep those places of contact dry, the parts become prematurely decayed."

The great points to be attained in a gate are strength, with sufficient lightness, and for these purposes nothing is better than iron. The *figure* represents a field and private gate of a light structure and considerable strength: it is of iron.

As iron is the best material for the gate, so hewn stone forms the best posts; when well grouted into the soil with cement, it lasts indefinitely long, and is firm and unyielding. The fastening is a subject for the inventive power of the farmer, and must



differ with the object in view. The sagging of the head of the gate may be in part remedied by making the upper timber very wide near the hinge and narrower to the head.

GATHERING. A common term for an abscess or tumour.

GATHERING FRUIT. The preservation of fruits for winter use and transportation obliges the orchardist to take great care that in gathering they are not bruised. The hand is the most ready and certain means of doing this; but there are several effective implements. One of the simplest consists of a disk of thin wood set around with wooden teeth, about four inches long, the enclosure having a diameter of eight or ten inches; to this is attached a long handle which fits at a considerable angle; so that, when the gatherer is used, the surface of the disk is nearly horizontal. The fruit is collected by reaching out the handle until the disk is brought under, then raising it so that the stem passes between two of the teeth; by these the fruit is to be drawn off: it then rests on the disk, and is brought to the ground without any injury. Such an implement may pull six or eight apples each time before being lowered, and is a very expeditious means of collecting fruits. It can be made on the farm in a very short time.

GAVELKIND. The practice of dividing real estate equally among all the children of the family.

GAUGING. Ascertaining the capacity of barrels, &c., by a gauging rod.

GAULT. Certain clays and marls lying under the upper green sand in England.

GEAR, GEARING. Harness, tackle. The apparatus of wheels in a machine.

GEHLENITE. A mineral, consisting of iron, silica, alumina, and lime. It consists of small gray or yellow crystals.

GEINE. The same as humus, geic acid, ulmin, humic acid. See *Humus*.

GELATIN. That species of animal matter which forms jelly with water when cold. Isinglass, glue, and size are representatives of this body in different states of purity. It abounds in skin, membranes, horns, and bones, but requires long boiling, at a high temperature, for its extraction. A very dilute solution is precipitated by infusion of galls, the product being leather.

Gelatin is not capable of itself to sustain life. Its composition is $C_{13} H_{10} N_2 O_5$, by Mulder. When moist, it runs into the putrefactive decay, yielding a fetid odour, carbonic acid, water, and ammonia. It is a powerful ammoniacal manure in this state, and is best economized in composts. Unboiled bones owe some part of their effects to the decay of their gelatin, which is present to the extent of thirty per cent.

GELDING. A castrated animal. The act of castrating. The most proper seasons are either the early spring months or those of the autumn.

GEMMA. A bud. Hence *gemmiparous*, bearing buds, or parts capable of development.

GENA. In zoology, the cheek, or part of the face between the eye and mouth.

GENERATION, EQUIVOCAL or SPONTANEOUS. Being produced without known parents. Originating without apparent seed or germs.

GENESEE OIL. A petroleum found floating on some of the waters of Western New-York, Ohio, Kentucky, &c.

GENICULATE. Bent at a sharp angle, like the flexed knee.

GENTIAN. A genus of highly ornamental plants; the roots of some afford fine bitters, especially the *Gentiana lutea* of Switzerland.

GENUS. *Plural*, *Genera*. In natural history, a distinct but lesser family of plants or animals which is grouped under one general name, and contains distinct species.

GEODES. Mineral masses having a hollow centre.

GEODESY (from γη, *the earth*, and δαιω, *I divide*). The measurement of the earth's surface.

GEOLOGY (from γη, and λογος, *a discourse*). The science which investigates the present appearance of the earth's surface, and the changes to which it has been subjected. The earth's crust is divided into four great divisions: 1st. The primitive period, epoch, or era, consisting of massive crystalline rocks. 2d The transition period and era, containing paving stones with few fossils, but stratified. 3d. Secondary rocks, less condensed, and containing many fossils. 4th. The tertiary period, era, or epoch, which consists of strata arranged in extensive basins, and contains many recent fossils. Besides these, drift materials, called diluvion, and the deposites of lakes and rivers, termed alluvion, cover extensive tracts. The causes producing change are, for the most part, those now in existence, as winds, the sea, rivers, vegetable and animal growth, volcanoes, icebergs, glaciers, bursting of lakes, &c. See the geological terms; also *Springs, Drainage.*

The study of geology is interesting to the farmer in furnishing him with certain rules for drainage, the determination of springs, and of the quality of soils.

GEOMETERS. Span worms. Caterpillars destructive to foliage.

GEOMETRY. The science of measures.

GEORGIA BARK. The bark of the *Pinckneya pubens*, a handsome tree of Florida.

"The wood of the Georgia bark is soft, and unfit for use in the arts; but its inner bark is extremely bitter, and appears to partake of the febrifuge virtues of the *Cinchona*, for the inhabitants of the southern parts of Georgia employ it successfully in the intermitting fevers which, during the latter part of summer and autumn, prevail in the Southern States. A handful of the bark is boiled in a quart of water till the liquid is reduced one half, and the infusion is administered to the sick From the properties of its bark the *Pinckneya* has taken the name of *Georgia bark.* The tree which produces it so nearly resembles the Peruvian vegetable, that some botanists have included them in the same genus."—(*Michaux.*)

GERM. The vital part or embryo.

GERMEN. The seed vessel, ovarium.

GERMINATION. The sprouting of seed. For its production, a temperature above 60° Fahrenheit, access of oxygen, and moisture are necessary; by hindering any of these, it will not take place, but the seed remains unchanged or rots. In germination moisture is first absorbed, and then oxygen: the latter, acting on the substances of the seed, produces carbonic acid and heat; starch becomes changed into a saccharine matter, and movements, resembling circulation, occur. The germ, expanding in both directions, puts out a root and seed leaves. Whatever hastens these changes assists germination; hence steeping in warm water, planting in loose soils near the surface, and securing a high temperature, all advance sprouting. Darkness is in some degree favourable to germination.

GESTATION. The period animals carry young.

"According to the observations of M. Teissier, of Paris, in 582 mares, which copulated but once, the shortest period was 287 days, and the longest, 419; making the extraordinary difference of 32 days, and of 89 days beyond the usual term of eleven months. The cow usually brings forth in about nine months, and the sheep in five. Swine usually farrow between the 120th and 140th day, being liable to variations, influenced, apparently, by their size and their particular breeds. In the bitch, on the contrary, be she as diminutive as a kitten, or as large as the boarhound, pupping occurs on or about the 63d day. The cat produces either on the 55th or 56th day. The true causes which abridge or prolong more or less the period of gestation in the females of quadrupeds, and of the incubation of birds, are yet unknown to us.

TABLE SHOWING THE PERIOD OF REPRODUCTION AND GESTATION IN DOMESTIC ANIMALS.

Kinds of Animals.	Proper Age for Reproduction.	Period of the Power of Reproduction.	Number of Females for one Male.	Period of Gestation and Incubation.		
				Shortest Period.	Mean Period.	Longest Period.
		Years.		Days.	Days.	Days.
Mare	4 years	10 to 12	—	322	347	419
Stallion	5 —	12 to 15	20 to 30	—	—	—
Cow	3 —	10 to 14	—	240	283	321
Bull	3 —	8 to 10	30 to 40	—	—	—
Ewe	2 —	6	—	146	154	161
Tup	2 —	7	40 to 50	—	—	—
Sow	1 —	6	—	109	115	143
Boar	1 —	6	6 to 10	—	—	—
She Goat	2 —	6	—	150	156	163
He Goat	2 —	5	20 to 40	—	—	—
She Ass	4 —	10 to 12	—	365	380	391
He Ass	5 —	12 to 15	—	—	—	—
She Buffalo	—	—	—	281	308	335
Bitch	2 —	8 to 9	—	55	60	63
Dog	2 —	8 to 9	—	—	—	—
She Cat	1 —	5 to 6	—	48	50	56
He Cat	1 —	9 to 10	5 to 6	—	—	—
Doe Rabbit	6 months	5 to 6	—	20	28	35
Buck Rabbit	6 —	5 to 6	30	—	—	—
Cock	6 —	5 to 6	12 to 15	—	—	—
Turkey, sitting on the eggs of the Hen	—	—	—	17	24	28
Turkey, sitting on the eggs of the Duck	—	—	—	24	27	30
Turkey, sitting on the eggs of the Turkey	—	—	—	24	26	30
Hen, sitting on the eggs of the Duck	—	—	—	26	30	34
Hen, sitting on the eggs of the Hen	—	3 to 5	—	19	21	24
Duck	—	—	—	28	30	32
Goose	—	—	—	27	30	33
Pigeon	—	—	—	16	18	20

"From some carefully collected and very extensive notes made by Lord Spencer on the periods of gestation of 764 cows, it resulted that the shortest period of gestation when a live calf was produced was 220 days, and the longest 313 days; but he was not able to rear any calf produced at an earlier period than 242 days. From the result of his experiments, it appears that 314 cows calved before the 284th day, and 310 calved after the 285th, so that the probable period of gestation ought to be considered 284 or 285 days. The experiments of M. Teissier on the gestation of cows are recorded to have given the following results:

21 calved	between the	240th and 270th day,	the mean	time being	$259\frac{1}{2}$
544	—	—	270th and 299th	—	—	282
10	—	—	299th and 321st	—	—	303

"In most cases, therefore, between nine and ten months may be assumed as the usual period; though, with a bull calf, the cow has been generally observed to go about 41 weeks, and a few days less with a female. Any calf produced at an earlier period than 260 days must be considered decidedly premature, and any period of gestation exceeding 300 days must also be considered irregular; but in this latter case the health of the produce is not affected. I will conclude this article with the remarks of Mr. C. Hilliard, of Northampton, who states that the period of gestation of a cow is 284 days, or, as it is said, nine calendar months and nine days; the ewe 20 weeks; the sow 16 weeks; the mare 11 months. The well-bred cattle of the present time appear to me to bring forth twins more frequently than the cattle did 50 years ago. The males of all animals, hares, excepted, are larger than the females. Castrated male cattle become larger beasts than entire males."—(*Blaine's Encyc.*)

GIBBOSE. Irregular, humped.

GIBBOUS. Protuberant, convex.

GIG. A well-known kind of light carriage drawn by one horse. *Gigs,* or *gig machines*, are rotatory cylinders, covered with wire teeth, for teaseling woollen cloth.

GILL. A quarter of a pint. A small valley or brook.

GILLENIA. One of the species (*G. trifoliata*) produces a root which is nearly as valuable as ipecacuanha as an emetic. It is indigenous in the woods of the Middle States.

GILLS. These organs in fishes answer the purpose of lungs. The plaits under mushrooms of the genus *Agaricus* are called gills.

GIN. Distilled spirit, flavoured with juniper berries. In machinery, an arrangement for tearing green seed cotton wool from the seeds. It consists of a cylinder closely set with saws, which pass through a grating in an inclined side-hopper, and thus drag off portions of wool, which are conveyed half round the cylinder, and then cleared off by a revolving brush, while the freed seeds slide through to the bottom of the hopper and escape. See *Cotton*.

It is also a machine used for raising great weights, driving piles, &c. It usually consists of three long legs or spars, which support a pulley at the top, round which a rope is passed for elevating the weight.

GINGER. *Zingiber officinale*. This plant is of the family *Scitamineæ*, a native of Hindostan, but also cultivated in the West Indies. The root is a rhizome, similar to that of the *flag*; it is perennial, but the leaves are annual. The root in the West Indies is taken up when a year old, immersed in boiling water to hinder future germination, dried, and sold. Sometimes it is prepared by taking off the outer skin, and in this state is called *white ginger*. It might be tried in our Southern States; all that is required is a well-tilled, light soil, with weeding. Probably the roots would not be so large as the Jamaica, but, from the high price of ginger, would probably pay well.

GINGER, WILD. A native species of the genus *Asarum*; it is of little note.

GINGLYMUS (from γιγγλυμος, *a hinge*). The hinge joint in animals, as the knee and elbow.

GINSENG. *Panax quinquefolium* (see *Fig.*). The root is fleshy from

one to three inches long, and about as thick as a finger, of a yellow colour, and somewhat resembling in flavour liquorice. It is almost destitute of medical virtue, but is esteemed by the Chinese, and exported for their use; in 1841 as much as $437,000 worth was sent out of this country. The plant is an herbaceous perennial, growing abundantly in the hilly and woody regions of the Northern, Middle, and Western States, whence it is collected with any cultivation.

GIRDER. In architecture, a principal beam in a floor for supporting the binding or other joists, whereby their bearing or length is lessened. Perhaps so called because the ends of the joists are enclosed by it.

GIRDLING TREES. Cutting a ring out of the trunk of a tree entirely through the new wood for the purpose of killing it; the girdling is most effective before the sap rises. *Rings* of bark, without touching the alburnum, are occasionally taken out of the branches of trees in spring to produce *fruiting* or develop the fruit; this, though frequently confounded with *girdling*, is altogether different, and does not kill the branch, unless too much bark is removed. A ring half an inch wide is enough on a branch two inches in diameter. The sap is hindered from descending by the wound.

GIZZARD. A strong, muscular

stomach in birds, for the purpose of grinding their food with pebbles. It answers the place of teeth.

GLABROUS. Smooth.

GLACIERS. Immense masses of ice produced from the snow of mountains occupying the valleys of Switzerland and countries equally elevated. In geology, the study of glaciers is peculiarly interesting; many are 10 to 15 miles long by two broad, and from 300 to 600 feet high.

GLAND. In anatomy, organs such as the liver, spleen, &c., which consist of an immense development of blood-vessels, and *secrete* a peculiar fluid, as bile, urine, &c. They are often microscopic, as the mucous glands of the intestines, and Peyer's glands. Sometimes they receive the specific name of the secretion they produce, as mucous glands, sebaceous glands, lymphatic glands, &c.

GLAND. In botany, small lumps of vegetable matter near leaves, or oval spots on the trunks of trees; they are unimportant except as a means of recognising species.

GLANDERS. See *Horse*.

GLASS. That used for conservatories should be of the greatest clearness. *Refuse* glass, pounded fine, has been used as a manure. The nature of the substance differs with the kind of glass, for *flint* glass is a mixture of sand, red-lead, and 14 per cent. of potash. *Crown*, or window glass, contains *soda*, with sand and lime. The silicate of potash or soda in these cases is very insoluble, and the effect produced cannot be considerable, unless a large dose is added. Pounded feldspar would form as good a manure. The pounded refuse is also used by glass-makers, and called *cullet*. The finest powder is used in making sand paper. Glass may be converted into soluble silicate of potash by fusion with its weight of potash or soda in a crucible.

GLASSWORT. The species of *Salicornia:* they grow on salt plains, and yield barilla by combustion.

GLAUBER'S SALT. Sulphate of soda. A saline purge used for horses and cattle. The dose is one quarter of a pound or more.

GLAUCOLITE. A mineral, containing 4½ per cent. potash, with silica, alumina, and 11 per cent. lime.

GLAUCOMA (from γλαυκος, *blue*). A disease of the eye, in which it becomes of a bluish colour.

GLAUCOPIS (from γλαυκος, and ωψ, *an eye*). A genus of passerine birds. Some of the species have wattles at the root of the beak.

GLAUCOUS. Sea-green, like the cabbage-leaf, having a light, bluish tint.

GLEANING. Collecting the refuse of the harvest.

GLEBE. A tract of land belonging to the Church.

GLENOID (from γληνη, *a cavity*). The articular cavities of bones.

GLIADINE. A name given by Taddei to the portion of gluten soluble in alcohol. Albumen.

GLIRES. The Linnean name for the *Rodentia*, from *glis, a dormouse.*

GLOBULAR. Spherical. *Globose*, resembling a sphere or globe.

GLOBULINE. A rather indefinite term used by botanists to describe spherical particles in plants, whether they be of colouring matter or starch. In physiology, it is the white albuminous substance forming the interior of the blood globules.

GLOMERATE GLAND. Any gland which discharges at once into a duct without having any cavity.

GLOMERULUS. A small capitulum, usually axillary, an old name for an inflorescence. When many branches terminate by little flower heads.

GLOSSO (from γλοττα, *the tongue*). A prefix to muscles, nerves, &c., attached to the tongue.

GLOTTIS. The upper opening of the windpipe. It is protected with a membrane called the *epiglottis.*

GLUCINUM. The metallic base of *glucina*, a rare earth, existing in the beryl, emerald, and euclase.

GLUCOSE. Grape sugar, starch sugar, sugar of diabetes, of honey. It is difficult to crystallize; exists in fruits, young stems; is readily fermentable; can be procured from starch by the action of dilute sulphuric acid and heat. It differs from cane sugar in containing more water, the formula being $C_{12}\ H_{12}\ O_{11} + 3$ Aq., when crystallized.

GLUE. Impure *gelatin*. It is obtained from clippings of skins, hoofs, &c. The refuse and spoiled glue form admirable nitrogen manures, yielding ammonia in decaying; 100 pounds of dry glue yield 9 pounds of ammonia. It has been used on turnips, and is well suited for cabbages and plants requiring much putrescent manure.

GLUME. The husk or chaff of wheat and grain plants. The awn is called an *arista*. *Glumosus*, furnished with glumes.

GLUTEN. The tenacious, semitransparent residue left on the cloth after washing dough with water. It is impure fibrin, and contains albumen. The amount in wheat is a test of its nutritiousness. When moist, gluten putrefies, and has the property of acting as a yeast or ferment on solutions of glucose. Most seeds contain a proportion of gluten, but wheat the greatest amount: nitrogen manures are said to increase the proportion. The macaroni and vermicelli of Italy are, for the most part, gluten. Dry gluten keeps well.

GLUTEUS (from γλουτος, *the buttocks*). The name of some of the muscles of the buttocks.

GLUTINOUS. Adhesive.

GLYCERIA FLUITANS. Water fescue, an indigenous grass growing on the margins of lakes and rivers, resembling the water rice. The seeds are eaten in Germany like millet.

GLYCERINE (from γλυκος, *sweet*). A gelatinous body of a sweet taste, left in solution in soap-making. It acts as a base in fats and oils, which are, indeed, salts of glycerine, stearates, oleates, or margarates of that body. In soap-making the potash or soda combines with the oily acid, and separates the glycerine. Its composition is $C_6\ H_7\ O_5 +$ Aq., and it nearly resembles gum. Liebig considers it an hydrated oxyde of *glyceryle*, with the latter of which the oily acids are combined in fats. Mulder has recently promulgated a new theory with respect to glycerine: he supposes the existence of a compound radical *lipyle* $= C_3\ H_2$; this forms a protoxide ($C_3\ H_2\ O$), called oxide of lipyle, which is the base in neutral fats, and that in saponification it unites with water as it is liberated, forming a compound of 2 atoms of lipyle with 3 of water.

Redtenbacher, on the other hand, maintains that the base in fats is *Acrolein* ($C_6\ H_4\ O_2$), and that glycerine is acrolein, with 3 atoms of water. This is the most satisfactory theory at present, for acrolein is a known body, which can be separated from glycerine by heating with phosphoric acid.

The glycerine refuse from soap-making is worthy of attention from farmers; it is at least as valuable an addition to the compost heap as peat, and much more destructible by fermentation and eremacausis.

GLYCION. Glycyrrhizine.

GLYCYRRHIZA. The generic name of *liquorice*.

GLYCYRRHIZINE. Glycion. Sugar extracted from liquorice and some sweet woods; it has the peculiarity of combining with acids and bases. It is neither crystallizable nor fermentable.

GLYPH. In architecture, a vertical groove.

GNATHIDIA (from γναθος, *a jaw*). In ornithology, the lateral parts or rami of the mandible or lower jaw, which are joined to the cranium behind, and meet in front at a greater or less angle.

GNATHOTHECA (from γναθος, and θηκη, *a sheath*). In ornithology, the horny or cutaneous integument of the beak.

GNATS. Insects of the family *Culicidæ*. Their bites are best treated with lard or olive oil, mixed with a little *ammonia*.

GNEISS. A stratified primary rock, composed of the same materials as granite, but the mica is somewhat distributed in layers, which give it a striped aspect. The gneiss rocks are remarkably rich in metallic ores.

GNOMON. The inclined rod or style on a sun-dial, the shadow of which marks the time. Their elevation depends upon the latitude. *Gnomonics* is the art of constructing dials.

GOAT. Animals of the genus *Capra*. The following is chiefly from Low:

"The goat appears to form the connecting link between the sheep on the one hand, and the antelope tribes on the other. Being the natural inhabitant of mountainous regions, it is, therefore, in wild, rocky countries that the goat is chiefly reared. Goats are stronger, more nimble, and less timid than sheep, and are more easily supported than any other animals, for there are few herbs which they do not relish; they will browse on heaths, shrubs, and plants which are rejected by other animals. Goats are more hardy and not liable to so many diseases as sheep. The goat is not well adapted to a country of enclosures, because it feeds upon the twigs of hedges, and escapes over the barriers intended to confine it; but where there are no young trees to be injured, they may browse at large on the mountain brakes without expense, and in winter, when housed, they are easily supported on straw, cabbage leaves, potato peelings, and such worthless food.

"It arrives early at maturity, and is very prolific, bearing two, and sometimes three kids at a birth. The period of gestation is five months. The female bears for six or seven years; the male should not be kept longer than five. In Portugal and some other countries, the goat is used as a beast of draught for light burdens. The hair of the goat may be shorn, as it is of some value, making good linsey. Ropes are sometimes made from goats' hair, and are said to last much longer, when used in the water, than those made of hemp. Candles are manufactured from their fat, which, in whiteness and quality, are stated to be superior to those of wax; their horns afford excellent handles for knives and forks, and the skin, especially that of the kid, is in demand for gloves and other purposes. Goats' milk is sweet and nutritive. When yielding milk the goat will give, for several months, at the average of two quarts per day. Mr. Pringle, of Kent, in his essay 'On Cottage Management' (*Gard. Mag.*, vol. v.), informs us that two milch goats are equivalent to one small Shetland cow. Cheese prepared from goats' milk is much esteemed in mountainous countries, after it has been kept a proper age."

The wool of the Cashmere goat is peculiarly silky, and forms an admirable material for the manufacture of shawls.

GOAT'S BEARD. The weed *Tragopogon pratensis*. Salsify (*T. porrifolius*) is sometimes so called.

GOLD. Gold coin may always be proved, if any counterfeit be suspected, by its great gravity of 17·157. Pure gold has a specific gravity of 19·3; the reduced weight of the coin is due to the alloy of copper. Its combining weight is 199·2, and symbol Au. (*aurum*). Aqua regia is the solvent of gold.

GOLDEN ROD. *Solidago virgaurea.* A common weed, found on poor, neglected fields. It is said by Bechstein to furnish a valuable yellow dye. Both the flowers and leaves produce a yellow decoction with water.

GOLD OF PLEASURE. *Camelina sativa.* A cruciferous small annual, bearing pale yellow flowers. It is cultivated like flax, prefers a light soil, and will yield two crops in the year: the seeds yield a sweet oil. This name is also improperly given to the *Madia*, which see. The camelina is sowed broadcast, weeded, and hoed, and ripens its seeds in about 90 days.

GOLD THREAD. *Coptis trifolia.* A small evergreen, indigenous to Canada and the Eastern States. It grows in dark, shady, Alpine swamps. The root is tonic.

GOMPHOSIS. In anatomy, a

junction of bones similar to that of the teeth in the jaw-bone.

GONIOMETER (from *γωνια, an angle*, and *μετρον, a measure*). An instrument to measure the angles of crystals.

GONYS. In ornithology, the inferior margin of the symphysis of the lower jaw.

GOOSE. See *Poultry*.

GOOSEBERRY. *Ribes grossularia*. In England the gooseberry is esteemed one of their most valuable fruits. In spring it furnishes the earliest as well as the best fruit for tarts and sauces, and can be preserved green as well as ripe for winter use. When ripe, it makes a delicious sweetmeat and wine, and is a favourite dessert.

The following selection is recommended: *Reds*—Old rough red, Melling's crown bob, Farmer's roaring lion, Knight's Marquis of Stafford, Champagne and Capper's top sawyer: one of the best of the red gooseberries is the Scotch ironmonger; it is hairy and thin-skinned. *Yellows*—Hill's golden gourd, Prophet's rockwood, Hamlet's kilton, Dixon's golden yellow, Gordon's viper. *Greens*—Edward's jolly tar, Massey's heart of oak, Nixon's green myrtle, early green hairy, Parkinson's laurel. *Whites*—Moore's white bear, Coleworth's white lion, Crompton's Sheba queen, Saunders's Cheshire lass, Wellington's glory, Woodward's whitesmith. Smooth skins become tough in cooking, and should not be selected for that purpose.

The gooseberry can be raised from cuttings, from suckers, or from seeds; the former is generally resorted to as being the most expeditious; and seed is only sown to raise new varieties. Cuttings may be planted in the fall, or as early in the spring as the weather will permit.

The gooseberry requires a deep, moist, and rich soil; the ground around it should be kept free from grass and mellow. It requires manure in spring. The fruit appears on shoots of the last year, and spurs of two or three years, the young shoots yielding the best. Keeping the bushes free of wood, open at the top, and removing all luxuriant shoots from the base, is the pruning necessary. Summer pruning is necessary for fine fruit.

The fruit is easily kept for tarts, by introducing them into bottles with a little water, heating until steam is produced, and then corking tightly. They may be kept whole by burning a few sulphur matches in a bottle-full, and corking tightly.

This shrub is much infested by caterpillars, insects, and blight; they are, however, all remedied by full exposure to the light, sprinkling with lime, or watering with a solution of tobacco or whale oil soap.

GOOSEFOOT. The popular name for the genus *Chenopodium*. They flourish on rank soils and about dunghills. The most important is *Ch. anthelminticum*, worm seed. Many are eaten by animals, and *C. album*, lamb's quarter, and *C. bonus Henricus* are used partially as spinach.

GOOSE GRASS. Several species of *Galium* are so called from being eaten by geese.

GOSSYPIUM. The generic name of the cotton plant. See *Cotton*.

GOULARD'S EXTRACT. A concentrated solution of sugar of lead in water: it is used diluted to *galls* and external inflammations.

GOURD. *Cucurbita lagenaria*. Calabash. Gourds are annuals readily cultivated, requiring a deep soil. Many varieties exist, of which the Patagonian, six feet long, is the most singular. The pulp is very purgative in most varieties.

GOVERNOR. In machinery, an arrangement for regulating the speed of machines.

GRACILE, GRACILIS. Slender.

GRACULA. The genus of jay birds. They are insectivorous.

GRADATORY. A term applied to those animals which have legs nearly of the same length, so that they can walk on the four. Birds which have the lower portion of their legs covered with feathers.

GRADIENTS. On railways, the ascending planes.

GRADUATED. Marked into regular divisions: increasing in equal measures.

GRADUATOR. A vessel or contrivance for increasing the extent of the surface of evaporation or oxidation, as by passing fermenting beer over chips contained in a large tub through which air passes, whereby the alcohol becomes oxidized, and converted into acetic acid. The process is called *graduation.*

GRAFTING. The propagation of one variety of plant on the *stock* or root of another. The small branch or scion of the improved kind usually contains three buds, but sometimes less; it should be selected from a healthy bearing branch, and be of the last year's growth, only three or four buds from the extremity. It should also be rather behind the stock in respect to vegetation, and for this purpose may be kept in moist sand or moss for a few days. When inserted, it should be kept bound for four weeks, to be well set, and afterward partially loosened, until it is so firm as not to be blown down by winds. When the scions have taken well, some of the natural buds of the stock should be taken off, but in an old stock it is not well to remove them altogether until the next year. Except when the scion is grafted on the root, one or more stock buds should be left until it has fairly started, and can consume all the sap rising into the stock. The stock influences the grafted tree in no respect except durability, size, and early maturity. For farther particulars, see the *Fruits.*

The following methods of grafting are from Judge Buel and Professor Lindley: "April is the general season for grafting, though it is sometimes performed in March, and sometimes omitted till May. The grafts should, however, be cut before the buds begin to swell. The scions are most likely to live if inserted when the sap is circulating freely, for then the wounds soonest heal.

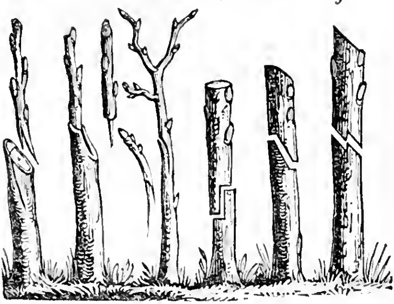
"The materials and implements required for grafting are, 1. A sharp knife to cut and pare the graft and stalk; 2. A strong knife and mallet to split the larger stalks, and a small hard wood wedge to put into the cleft while the scion is fitted to its place; 3. Strips of bass matting, or other soft string, to tie around the stalk and graft; and, 4. Some good grafting-wax or prepared clay, to cover over the worked part. If clay is used, it should be previously well beaten, and a portion of fresh horse-dung mixed with it during the operation. A grafting-wax, which we have used for years with success, is made by mixing and melting together four parts of rosin, two parts of tallow, and one part of bees' wax; the whole to be afterward incorporated and worked by the hand, like shoemaker's wax. This may be applied over the grafted part in a thin layer, or first spread on a cloth and then applied in strips of proper size. The wax or clay is applied, 1. To prevent the flowing of the sap from the wounds; 2. The too sudden drying of the wood; and, 3. The introduction of rain water into the wound or cleft. It is evident, therefore, that whatever sort of coating is adopted, it should be applied without delay, and so as effectually to exclude air and water.

"The object to be aimed at in the process of grafting, is to bring the inner bark and the sap-wood of the stalk and scion in nice contact, so that the ascending sap of the stalk will pass freely into the sap-wood of the scion, and the descending sap of the scion, which has been elaborated and prepared in the leaves, and which descends through the inner bark, to pass freely into the inner bark of the stalk. This elaborated sap soon hardens into wood, and covers and heals the wound.

"There are more than forty different modes of grafting. We shall only speak of those which are best adapted to the practice of the orchard and garden.

"*Cleft-grafting* (*Fig.* 1, *b*) is most practised upon strong stalks, or in

Fig. 1.



heading down or regrafting old trees. There are two methods of doing this: one described in the cut, where the stalk is first cut off obliquely, and the sloped part is then cut off horizontally near the middle of the slope; a cleft nearly two inches long is then made with a sharp knife or chisel, in the crown, downward, at right angles with the sloped part, taking care not to divide the pith. The cleft is kept open by the knife or the small wedge; the scion has its extremity, for about an inch, cut into the form of a wedge: it is left about the eighth of an inch thick on the bark side, and brought to a fine edge on the inside. It is then inserted into the opening prepared for it; and the knife or wedge being withdrawn, the stalk closes firmly upon it. The other and the more common mode is to saw off the stalk horizontally, make the cleft through its centre, and insert either one or two grafts in the outer edges. In both cases the stalk should be tied and covered with the wax or clay.

"*Whip-grafting* (*Fig.* 1, *a*), or, as it is sometimes called, tongue-grafting, is mostly adopted in nurseries, where the stalks are generally small. It is desirable that the stalk and graft should be of nearly similar size. The scion and stalk are cut off obliquely, at corresponding angles, as near as the operator can guess; then cut off the tip of the stalk obliquely, or nearly horizontally; make now a slit nearly in the centre of the sloped face of the stalk downward, and a similar one in the scion upward. The tongue or wedge-like process, forming the upper part of the sloping face of the scion, is then inserted downward in the cleft of the stalk; the inner barks of both being brought closely to unite on one side, so as not to be displaced in tying, which ought to be done immediately, with a riband of bass or other soft string, brought in a neat manner several times round the stalk. The next and finishing operation is to cover the whole wound with the prepared wax or clay already described. The French mode of whip-grafting, which is also in common use here, differs from the English, in their never paring more off the stalk, however large, than the width of the scion (*Fig.* 2, *a*, *b*, *c*, *d*). In both, the stalk is sometimes left a few inches above the graft till autumn, to tie the young shoot to, lest it be blown off.

"*Side-grafting* (*Fig.* 1, *c*) resembles whip-grafting, except it is performed without taking off the top of the stalk.

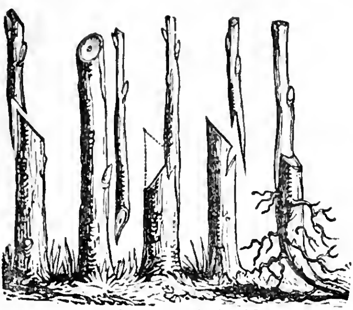
"*Shoulder or chink grafting* is performed with a shoulder, and sometimes also with a stay at the bottom of the slope. It is chiefly used for ornamental trees, where the scion and stalk are of the same size (*Fig.* 1, *d*, *e*, *f*).

"*Grafting in the root* is sometimes performed in nurseries, where stalks are scarce, as described in *Fig.* 2, *e*."

"The season for performing the

Fig. 2.

a b c d e



operation is, for all deciduous trees and shrubs, the spring, immediately before the movement of the sap. The spring is also the most favourable period for evergreens; but the sap in this class of plants being more in motion during winter than that of deciduous plants, grafting, if thought necessary, might be performed at that season.

"*Grafting Timber-trees.*—The oak, ash, hornbeam, and hazel may be grafted, but there is a little difficulty in grafting some of the hard-wood trees. The lucombe, and other oaks of that kind, require to have the Turkey oak for a stock; and the evergreen oaks must have their own species. The common ash will take with the *ornus*, and any of the hardy varieties of true ashes, such as the Chinese and entire-leaved. The hornbeam may be used as a stock for *Carpinus orientalis*, and the cut-leaved sort; but the scions must be from two years' old wood. The purple-leaved hazel may be grafted on the hazel stocks.

"*Grafting by approach*, or inarching, is a mode of grafting in which, to make sure of success, the scion is not separated from the parent plant till it has become united with the stock. Inarching is chiefly practised with camellias, myrtles, jasmines, walnuts, firs, &c., which do not flourish by the common mode of grafting.

"*Grafting herbaceous plants* differs in nothing from grafting such as are of a woody nature, excepting that this operation is performed when both stock and scion are in a state of vigorous growth. The only useful purpose to which this mode has been hitherto applied is that of grafting the finer kinds of dahlias on tubers of the more common and vigorous growing sorts. In the Paris gardens, the tomato is sometimes grafted on the potato, the cauliflower on the borocole, and one gourd on another, as matter of curiosity.

"*Grafting the herbaceous shoots of woody plants* has been extensively employed by French nurserymen, and even in some of the forests of France. The scions are formed of the points of growing shoots; and the stocks are also the points of growing shoots cut or broken over an inch or two below the point, where the shoot is as brittle as asparagus. The operation is performed in the cleft manner; that is, by cutting the lower end of the scion in the form of a wedge, and inserting it in a cleft or slit made down the middle of the stock. The finer kinds of azaleas, pines, and firs are propagated in this way, and thousands of *Pinus larix* have been so grafted on *Pinus sylvestris* in the forest of Fontainebleau. At Hopetoun House, near Edinburgh, this mode of grafting has been successfully practised with *Abies Smithiana*, the stock being the common spruce fir."

GRAIN. The unit of weight. See *Weights* and *Measures*.

GRAINS. The fruit or seeds of gramineous plants, with beans, pease, &c. The weight of wheat and some few other grains is established by statute. Thus, in New-York a bushel weighs,

	Standard.		Common Weight.
Of wheat . . .	60	—	55 to 65
Of rye	56	—	46 to 56
Of barley . . .	48	—	44 to 56
Of oats	32	—	28 to 44
Of Indian corn .	56	—	50 to 62

GRAINS, BREWERS' AND DISTILLERS'. The refuse of the mash tub. Brewers' grains are best, as they use barley: distillers employ rye or corn. It is difficult to give any valuation for this kind of food; but there is no question of the nutritiousness, as large dairies, near cities, are kept in full vigour and milk by them, mixed with cut straw or hay, and pigs rapidly fattened. A milch cow requires about one bushel daily. Grains rapidly heat and putrefy if exposed to air and a spring or summer heat, but they may be readily preserved by the following process described by Mr. Youatt:

"The grains are laid up in pits lined with brick-work, set in cement, from ten to twenty feet deep, and of any convenient size. They are firmly trodden down, and covered with a layer of moist earth, eight or nine inches thick, to keep out the rain and frost in winter, and the heat in summer. The grains are, if possible, thrown into the pit while warm and in a state of fermentation, and they soon turn sour; but they are not liked the worse by cattle on that account; and the air being perfectly excluded, the fermentation cannot run on to putrefaction. The dairymen say that the slow and slight degree of fermentation which goes on tends to the greater development of the saccharine and nutritive principle; and they will have as large a stock on hand as they can afford, and not open the pits till they are compelled. It is not uncommon for two years to pass before a pit of grains is touched; and it is said that some have lain nine years, and been perfectly good at the expiration of that period."

Grains have been used as manure with great success. They are best adapted to grass, wheat, corn, and the cerealia generally: 20 bushels to the acre are an abundant application. Mr. Buckland, of Wales, produced two and a half tons of hay off land formerly yielding but half a ton, by a sprinkling of grains only. This result is to be expected, as the husk of barley, &c., contains nearly all the saline matters of the plant.

GRAIN WEEVILS. See *Wheat Insects*.

GRAIP. A Scotch name for the various kinds of forks used in husbandry.

GRALLÆ (from *grallæ, stilts*). The tribe of long-legged wading birds, as the cranes, flamingo.

GRAMA GRASS. A grass indigenous in the West Indies and in Mexico, of small size, growing on poor land, and bearing a very nutritious grain, which it retains until spring. It is highly recommended for cultivation in the Southern States. It must not be confounded with the *gamma*, or buffalo grass. From the description given by Captain Cook, United States Army, it appears to be a stoloniferous grass, and perennial.

GRAMINACEÆ. Gramineous plants. Grasses. Endogenous plants, in which the parts of fructification are essentially perfect, although they are in a very unusual state in what may be called their accessory organs. They have neither calyx nor corolla; but, in lieu of them, imbricated scales, called paleæ and glumes; the latter of which give rise to the name *glumaceous*, often applied to these plants. Corn of all kinds, the bamboo, the sugar cane, many kinds of pasture plants, and reeds, belong to different species of *Graminaceæ*. The flinty surface of the stems or straw renders many valuable for domestic use, as for forming the *plat* from which straw bonnets, &c., are manufactured. They constitute the most valuable family of plants for the sustenance of men and animals. They are developed from the frigid zone to the equator, increasing in size as they proceed south.

GRAMME. The unit of French weights, equal to 15·434 troy grains. The following is their decimal system:

		Grammes.		Troy grains.
Milligramme .	=	,001	=	,01543
Centigramme .	=	,01	=	1,5434
Decigramme .	=	,1	=	1,5434
Gramme . . .	=	1,	=	15,434
Decagramme .	=	10,	=	154,34
Hectogramme .	=	100,	=	1543,4
Kilogramme .	=	1000,	=	15434
Myriagramme .	=	10000,	=	154340

The gramme equals the weight of the hundredth part of a cubic metre of distilled water at 32° Fahrenheit. The kilogramme is used for heavier weights, and is equal to two pounds, three ounces, and 4·428 drachms avoirdupois.

GRANARY. A place where wheat or corn is stored; it should be airy, dry, and so situated as to be out of the reach of vermin. Where the weevil appears, the grain, before storage, should be kiln-dried at about 180° Fahrenheit. Rats and mice are kept out if the granary be erected on stones or piles of a conical form, and inverted. In Egypt and Sicily corn is stored in deep vaults or cellars made of brick, or cut in the rocks, and covered tightly by a rock with earth piled upon it: in this case the grain must be thoroughly dried before storage. When the granary is airy, it is advisable to stir the grain occasionally, so as to expose it equally.

GRANGE. A farm-yard with suitable offices.

GRANITE. A crystalline rock composed of quartz, mica, and feldspar. The greater the proportion of quartz the better the rock for building purposes, as the feldspar decays. Some granites contain a variety of feldspar which decomposes with great rapidity, so that it is used for making pottery. Granite is supposed by geologists to be of igneous origin; it protrudes through other formations, and also occurs in veins. It is the principal rock of the *Primitive* series, and its ingredients constitute, in different combinations, most other rocks. The variety called blue granite, Massachusetts granite, or syenite, contains hornblende in the place of mica, and is a more valuable building material. When granite is to be worked it should be kept under water, as it becomes very hard in air. The chemical composition of granite depends upon the proportions of the minerals present. The quartz is silica only; the feldspar contains from 11 to 14 per cent. of potash; the mica from seven to ten of potash. See *these minerals*.

GRANIVORÆ. Birds, including the incessores, which eat grain. *Granivorous* is used to designate grain-eating animals.

GRANULATE (from *grana, a grain*). To form into grains, or become covered with minute granules.

GRANULATION. In chemistry, the reduction of metals into smaller parts: it is performed by pouring small portions of the molten matter into water, and sometimes first passing it through a wire sieve. In surgery, the production of granules of flesh on the surface of wounds.

GRAPE. See *Vine*.

GRAPE SUGAR. *Glucose*.

GRAPHOMETER (from γραφω, *I write*, and μετρον, *a measure*). A name for the semicircle of land surveyors.

GRAPHITE. Plumbago, black-lead. The coarse kinds are used in making crucibles.

GRASSES. The lesser graminaceæ, which do not bear grains sufficiently large for collection as food. Clovers, lucern, and leguminous plants are also improperly included under grasses.

The true grasses are very numerous, but experience has selected some few as worthy of cultivation, from their greater nutritiousness or adaptation to the wants of the farm. These are divided into temporary hay grasses, intended for rotations; permanent hay grasses; grasses affording hay, but peculiar to certain localities, and pasture grasses.

The following is chiefly from Loudon: "Though grasses abound in every soil and situation, yet all the species do not abound indifferently; on the contrary, no class of plants is so absolute and unalterable in its choice in this respect. The creeping-rooted and stoloniferous grasses will grow readily on most soils; but the fibrous-rooted species, and especially the more delicate upland grasses, require particular attention as to the soil in which they are sown; for in many soils they will either not come up at all, or die away in a few years, and give way to the grasses which would naturally spring up. Hence, in sowing down lands for permanent pasture, it is a good method to make choice of those grasses which thrive best in adjoining and similarly-circumstanced pastures for a part of the seed; and to mix with these what are considered the very best kinds.

"The most important feature in the culture of pasture grasses is mixture of sorts. The husbandman who clothes his fields only with rye-grass and clover, employs a limited machinery, the former being unproductive in summer, the latter moderately so in spring; but when he, for this purpose, uses a variety of plants differing in their habits of growth and periods of luxuriance, a numerous and powerful machinery is kept successively in full operation.

"The effect of a mixture of grasses may be accounted for from some species putting forth their foliage, and reaching a maximum of produce at different periods from other kinds. From some being gregarious or social, and others solitary, and never producing a close turf, by sowing seeds of several species together, which are dissimilar in their habits of growth, and arrive at a maximum of produce at different periods of summer and autumn, there is secured throughout the season a succession of fresh herbage, rendered, by the erect and creeping foliage of the different species, so dense and abundant as greatly to surpass in quantity that obtained from the cultivation of two or three kinds only.

"New and excellent varieties of many of the grasses, especially those used or fit to be used in the convertible husbandry, might, no doubt, be obtained by selection and cross-breeding, and it is much to be wished that this were attempted by cultivators.

"*Tall or Hay Grasses of temporary Duration.*—The most valuable of this division are the biennial, or, as it is commonly but erroneously called, the annual, perennial, and subperennial rye grass (*a*), the cocksfoot grass (*b*), and woolly soft grass (*c*). Where a crop of hay is desired within the year, it is necessary to resort to such grasses as are annuals in the strict sense of the word; and none can be

Fig. 1.

Most valuable temporary hay grasses.

better for this purpose than the common oat, *Avena sativa*, cut and made into hay when it comes into flower. Next in order may be mentioned the other cereal grasses and the annual varieties of Bromus; the latter, however, are very coarse grasses, though prolific in culm.

"The biennial rye grass, *Lolium perenne var. bienne*, is well known as being universally sown, either with or without clover, among grain crops, with a view to one crop of hay in the succeeding season. It attains a greater height, and produces a longer, broader spike of flowers than the perennial rye grass, and the produce in hay is considered greater than that of any other annual grass equally palatable to cattle. It prefers a rich loamy soil, but will grow on any surface whatever, not rock or undecayed bog.

"The perennial rye grass (*Lolium perenne*, Lin., and *Loglio virace*, Ital.) differs from the other in being of somewhat smaller growth, and in abiding for several years, according to the variety and the soil and culture. Pacey's and Russell's varieties of rye grass are most esteemed.

"Many consider this grass coarse, benty, and very exhausting to the soil; but after all the experiments that have been made on the other grasses, none have been found to equal it for a course of mowing and pasturing for two, three, or seven years. It is sown in Italy, and especially in Lombardy, and also in France and Germany, along with clover, for the same purposes as in this country; and, as Von Thaer has remarked, though some have tried other species, both in these countries and in England, they have in the end returned to rye grass. When intended as a pasture grass, if stocked hard, and when for hay, if mown early, the objections to it are removed.—(*Code of Agriculture.*) G. Sinclair says the circumstance of its producing abundance of seed, which is easily collected, and vegetates freely on any soil, its early perfection and abundant herbage the first year, which is much relished by cattle, are the merits which have upheld it to the present day, and will probably for some time to come continue it a favourite grass among farmers. But the latter-math is inconsiderable; the plant impoverishes the soil in a high degree if not cut before the seed ripens. When this is neglected, the field after midsummer exhibits only a brown surface of withered straws.

"The cocksfoot grass, orchard grass (*Dactylis glomerata*, Linneus), is an imperfect perennial, and grows naturally on dry, sandy soils. This grass may be known by its coarse appearance, both of the leaf and spike, and also by its whitish green hue.

"One writer says he has cultivated it largely, and to his satisfaction, on wet loams on a clay marl bottom, upon which the finer grasses are apt to give way in a few years to the indigenous produce. If suffered to rise high, it is very coarse; but, fed close, is a very valuable sheep pasture. He has sown two bushels an acre, and 10 lbs. common red clover; and when the clover wears out, the grass fills the lands and abides well in it. It grows well in winter. It has been found highly useful as an early sheep feed. It is early, hardy, and productive, but is a coarser plant than rye grass, and requires even greater attention in regard to being cut soon or fed close. It does best by itself, and the time of its ripening being different from that of clover, it does not suit well to be mixed with that plant. The pasturage it affords is luxuriant, and particularly agreeable to sheep. It is cultivated to a great extent, and with astonishing success at Holkham. The quantity of sheep kept upon it, summer and winter, is quite surprising and the land becomes renovated by lying two or three years under this grass, and enriched by the manure derived from the sheep. A field in the park at Woburn was laid down in two equal parts, one part with rye grass and white clover, and the other part with cocksfoot and red clover; from the spring till midsummer the sheep kept almost constantly on the rye grass, but after that time they left it, and adhered with equal constancy to the cocksfoot during the remainder of the season. In *The Code of Agriculture* (p. 497, 3d. edit.) it is stated, that Sinclair of Woburn considers 'no grass so well suited for all purposes as cocksfoot.'

"The woolly soft grass (*Holcus lanatus*, Linneus) is an imperfect perennial, and rather late flowering grass, of a short, unsubstantial appearance, and found chiefly in poor, dry soils. It is, however, a very common grass, and grows on all soils, from the richest to the poorest. It affords abundance of seed, which is light, and easily dispersed by the wind.

"It was cultivated at Woburn on a strong clayey loam, and the proportional value which the grass at the time the seed is ripe bears to the grass at the time of flowering is as eleven to twelve. Young observes of this grass, that it flourishes well on any moist soil, and should be sown chiefly with a view to sheep, for it is not so good for other stock; many acres of it have been cultivated on his farm for sheep, and it has answered well when kept close fed.

"*Tall or Hay Grasses of permanent Duration.*—No permanent grass has been found equal to the rye grass for the purposes of convertible husbandry, but others have been selected which are considered superior for hay meadows. The principal of these are the fescue, foxtail, and meadow grass. Agriculturists, indeed, are not all agreed on the comparative merits of these grasses with rye grass; but there are none who do not consider it advisable to introduce a portion of each, or most of these species along with rye grass, in laying down lands to permanent pasture.

"Of the fescue grass there are three species in the highest estimation as meadow hay grasses, viz., the meadow, tall, and spiked fescue (*Fig.* 2, *a*, *b*, *c*).

Fig. 2.

Tall hay grasses of permanent duration.

"The *F. pratensis* (*a*), or the meadow or fertile fescue grass, is found indigenous in the United States, in most rich meadows and pastures, and is highly grateful to every description of stock. It is more in demand for laying down meadows than any other species except the rye grass.

"The tall or infertile fescue grass (*Festuca elatior*, *E. B.*, *b*) is indigenous, and closely allied to the *Festuca pratensis*, from which it differs in little except that it is larger in every respect. The produce is nearly three times that of the *F. pratensis*, and the nutritive powers of the grass are superior, in direct proportion, as six to eight. The proportional value which the grass at the time the seed is ripe bears to the grass at the time of flowering is as twelve to twenty. The proportional value which the grass of the latter-math bears to that of the crop is as sixteen to twenty, and to the grass at the time the seed is ripe as twelve to sixteen inverse. Curtis observes that, as the seeds of this plant, when cultivated, are not fertile, it can only be introduced by parting its roots and planting them out; in this there would, he says, be no great difficulty, provided it were likely to answer the expense, which he is strongly of opinion it would in certain cases; indeed, he has often thought that meadows would be best formed by planting out the roots of grasses, and other plants, in a regular manner; and that, however singular such a practice may appear at present, it will probably be adopted at some future period; this great advantage would, he says, attend it, noxious weeds might be more easily kept down, until the grasses and other plants had established themselves in the soil.

"The spiked fescue grass, or darnel fescue grass (*Festuca loliacea*, Linneus, *c*), resembles the rye grass in appearance, and the tall fescue grass in the infertility of its seeds. It is considered superior to rye grass either for hay or permanent pasture, and improves in proportion to its age, which is the reverse of what takes place with the rye grass.

"The meadow foxtail grass (*Alopecurus pratensis*, *d*) is found indigenous in most meadows; and when the soil is neither very moist nor very dry, but in good heart, it is very productive. It also does well on water meadows. Sheep and horses seem to have a greater relish than oxen for this grass.

"In the Woburn experiments, it was tried both on a sandy loam and a clayey loam, and the result gave nearly three fourths of produce greater from a clayey loam than from a sandy soil, and the grass from the latter is comparatively of less value, in proportion as four to six. The straws produced by the sandy soil are deficient in number, and in every respect less than those from the clayey loam; which will account for the unequal quantities of the nutritive matter afforded by them; but the proportional value in which the grass of the latter-math exceeds that of the crop at the time of flowering is as four to three; a difference which appears extraordinary, when the quantity of flower stalks which are in the grass at the time of flowering is considered. Next to the fescue, this grass is in the greatest reputation for laying down mowing grounds; but it is, unfortunately, subject to the rust in some situations.

"Of the meadow grass there are two species in esteem as hay plants, the smooth-stalked and roughish.

"The great, or smooth-stalked meadow grass, the spear grass of some parts of the United States (*Poa pratensis*, *e*), is distinguished by its height, smooth stem, and creeping roots. According to Sole, it is the best of all the grasses: its foliage begins to shoot and put on fine verdure early in the spring, but not so soon as some other grasses. Every animal that eats grass is fond of it, while it makes the best hay, and affords the richest pasture. It abounds in the best meadows, and has the valuable property of abiding in the same land, while most other grasses are continually changing. According to some, it delights in rather a dry than a moist soil and situation, on which account it keeps its verdure better than most others in dry seasons; but it thrives most luxuriantly in rich meadows.

"By the Woburn experiments, the proportional value in which the grass of the latter-math exceeds that of the flowering crop is as six to seven. The grass of the seed crop and that of the latter-math are of equal value. This grass is, therefore, of least value at the time the seed is ripe; a loss of more than one fourth of the value of the whole crop is sustained if it is not cut till that period; the straws are then dry, and the root leaves in a sickly, decaying state; those of the latter-math, on the contrary, are luxuriant and healthy. This species sends forth flower stalks but once in a season, and those being the most valuable part of the plant for the purpose of hay, it will, from this circumstance, and the superior value of the grass of the latter-math, compared to that of the seed crop, appear well adapted for permanent pasture. It was of this grass that the American prize bonnet, in imitation of Leghorn, was made by Miss Woodhouse. This grass belongs to the same genus, and nearly resembles the rich Kentucky *blue grass*, which seems, indeed, to be only a variety rather less in size.

"The roughish meadow grass (*Poa trivialis*, L., *f*) delights in moist, rich, and sheltered situations, when it grows two feet high, and is very productive. It is indigenous. The deficiency of hay in the flowering crop, in proportion to that of the seed crop, is very striking. Its superior produce, the highly nutritive powers which the grass seems to possess, and the season in which it arrives at perfection, are merits which distinguish it as one of the most valuable of those grasses which affect moist, rich soils and sheltered situations; but on dry, exposed situations it is altogether inconsiderable: it yearly diminishes, and ultimately dies off, not unfrequently in the space of four or five years.

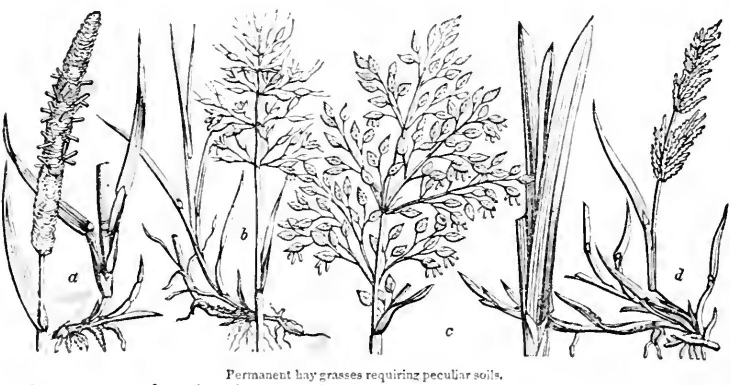
"The above are six of the best permanent grasses for either dry or watered meadows. The seeds of the meadow fescue, foxtail, and smooth and rough meadow grasses are sown in various proportions with the clovers and rye grass. The seeds of the two sorts of meadow grass are apt to stick together, and require to be well mixed with the others before being sown. The tall and spiked fescue grasses, having a number of barren flowers, are not prolific in seeds, and they are therefore seldom to be got at the seed-shops. To this list may be added Andes grass (*Avena* (*Festuca*) *elatior*), which, on strong lands, produces a good crop, and is remarkably early in the United States: it may be pastured with success, and should be cut before seed, as it becomes coarse. See *Bermuda* and *Grama Grass.*

"As hay grasses, adapted for particular soils and situations, the cat's-tail or Timothy, floating fescue, fiorin, and herd's grass, have been recommended; but it cannot be said that the opinions of cultivators are unanimous in their favour. Timothy has certainly been found to answer well on moist, peaty soils, and in several cases fiorin also.

"The cat's-tail, or Timothy grass (*Phleum pratense*, L., *Fig.* 3, *a*,), is a naturalized plant, and grows both in dry and moist soils. On moist, rich soils it is a prolific grass, but late; on dry soils it is good for little, and for cultivation in any way is disapproved of by Withering, Swaine, Curtis, and others, as having no properties in which it is not greatly surpassed by the meadow foxtail.

The Woburn experiments, however, present this grass as one of the most prolific for hay. The comparative merits of this grass appear to be very great; to which may be added the abundance of fine foliage that it produces early in the spring. In this respect it is inferior to *Poa fertilis* and *Poa angustifolia* only. The value of the straws at the time the seed is ripe exceeds that of the grass at the time of flowering in the proportion of twenty-eight to ten, a circumstance which raises it above many others; for from this property its valuable early foliage may be depastured to an advanced period of the season, without injury to the crop of hay, treatment which, in grasses that send forth their flowering straws early in the season, would cause a loss of nearly one half in the value of the crop, as clearly proved by former examples; and this property of

Fig. 3.



Permanent hay grasses requiring peculiar soils.

the straws makes the plant peculiarly desirable for hay. In moist and peaty soils it has in various instances been found highly productive.

"The floating fescue grass (*Festuca fluitans*, *b*) is found in rich marshes.

"It is greedily devoured by every description of stock, not excepting hogs and ducks, and geese eagerly devour the seeds, which are small, but very sweet and nourishing. They are collected in several parts of Germany and Poland, under the name of manna-seeds (*schwaden*), and are esteemed a delicacy in soups and gruels. When ground to meal, they make bread very little inferior to that from wheat. The bran is given to horses that have the worms, but they must be kept from water for some hours afterward. Geese and other water-fowl are very fond of the seeds. So also are fish; trout, in particular, thrive in those rivers where this grass grows in plenty. It has been recommended to be sowed on meadows that admit flooding; but Curtis justly remarks that the flote fescue will not flourish except in land that is constantly under water, or converted into a bog or swamp.

"The water meadow grass (*Poa aquatica*, *c*) is found chiefly in marshes in the north and in Canada, but will grow on strong clays, and yield, as the Woburn experiments prove, a prodigious produce, flowering from June to September. It is one of the largest grasses, rising to five feet.

"The fiorin grass (*Agrostis stolonifera*, *d*) is a very common grass, both in wet and dry, rich and poor situations. It is known in the United States as *Agrostis decumbens*, and is a variety of *A. alba*. Few plants appear to be more under the influence of local circumstances than this grass. On dry soils it is worth nothing, but on rich, marl soils, and in a moist soil, if we may put confidence in the accounts given of its produce in Ireland, it is the most valuable of all herbage plants.

"It was first brought into notice by Dr. Richardson in 1809, and subsequently extolled, and its culture detailed in various pamphlets by the same gentleman. It appears to be exclusively adapted for moist peat soils or bogs. In *The Code of Agriculture* it is said, 'On mere bogs, the fiorin yields a great weight of herbage, and is, perhaps, the most useful plant that bogs can produce." According to Sir H. Davy, the fiorin grass, to be in perfection, requires a moist climate or a wet soil; and it grows luxuriantly in cold clays unfitted for other grasses. In light sands, and in dry situations, its produce is much inferior as to quantity and quality. He saw four square yards of fiorin grass cut in the end of January, in a meadow, exclusively appropriated to the cultivation of fiorin by the Countess of Hardwicke, the soil of which is a damp, stiff clay. They afforded twenty-eight pounds of fodder, of which one thousand parts afforded sixty-four parts of nutritive matter consisting nearly of one sixth of sugar, and five sixths of mucilage, with a little extractive matter. In another experiment, four square yards gave twenty-seven pounds of grass. Lady Hardwicke has given an account of a trial of this grass, wherein twenty-three milch cows, and one young horse, besides a number of pigs, were kept a fortnight on the produce of one acre. On the Duke of Bedford's farm, at Maulden, fiorin hay was placed in the racks before horses, in small, distinct quantities, alternately with common hay; but no decided preference for either was manifested by the horses in this trial. Fiorin has been tried in the highlands of Scotland, and a premium awarded in 1821 for a field of three acres planted on land previously worth very little, at Appin, in Argyleshire. (*Highl. Soc. Trans.*, vol. vi., p. 229.) Hay tea has also been made from fiorin, and found useful in rearing calves, being mixed with oatmeal and skimmed milk.—(*Ibid.*, p. 233.)

"There are other species of *Agrostis*, as the *A. palustris* and *repens*, and some varieties of the *A. stolonifera*, that on common soils are little different in their appearance and properties from fiorin. On one of these, the narrow-leaved creeping bent (*A. stolonifera var. angustifolia*), the following remarks are made in the account of the Woburn experiments: 'From a careful examination of the creeping bent with narrow leaves, it will doubtless appear to possess merits well worthy of attention, though perhaps not so great as they have been supposed, if the natural place of its growth and habits be impartially taken into the account. From the couchant nature of this grass, it is denominated couch grass by practical men, and from the length of time that it retains the vital power after being taken out of the soil, it is called squitch, quick, full of life,' &c.

"The culture of fiorin is different from that of other grasses. Though the plant will ripen its seeds on a dry soil, and these seeds being very small, a few pounds would be sufficient for an acre, yet it is generally propagated by stolones or root shoots. The ground being well pulverized, freed from weeds, and laid into such beds or ridges as the cultivator may think advisable, small drills an inch or two deep, and six or nine inches asunder, are to be drawn along its surface, with a hand or horse hoe, or on soft lands with the hoe-rake. In the bottom of these drills, the fiorin shoots (whether long or short is of no consequence) are laid lengthways, so that their ends may touch each other, and then lightly covered with a rake, and the surface rolled to render it fit for the scythe. In six months the whole surface will be covered with verdure, and if the planting be performed early in spring, a large crop may be had in the following autumn. Any season will answer for planting, but one likely to be followed by showers and heat is to be preferred. Those who wish to cultivate this grass will consult Dr. Richardson's *New Essay on Fiorin Grass* (1813), and also *The Farmer's Magazine* for 1810–14. Our opinion," says Loudon, "is that neither fiorin, Timothy, nor floating fescue is ever likely to be cultivated in Britain; though the latter two may perhaps succeed well on the bogs and moist, rich soils of Ireland, where, to second the influence of the soil, there is a moist, warm climate.

"The preparation of the soil, and the sowing of the usual meadow grasses, differ in nothing from those of clover and rye grass already given.

"*Grasses chiefly adapted for Pasturage.*—In treating of pasturage grasses, we shall make a selection of such as have been tried to some extent, and of which the seeds are in the course of commerce. On soils in good condition, and naturally well constituted, no better grasses can be sown for pasturage than those we have described as tall grasses for hay meadows; but for early and late pasturage, and secondary soils, there are others much more suitable.

"The pasture grasses for early pasturage on all soils are the *Anthoxanthum odoratum*, *Holcus odoratus*, *Avena pubescens*, and *Poa annua*.

"The pasture grasses for late herbage on all soils are chiefly the different species of *Agrostis* (bents) and *Phleum* (cat's-tail).

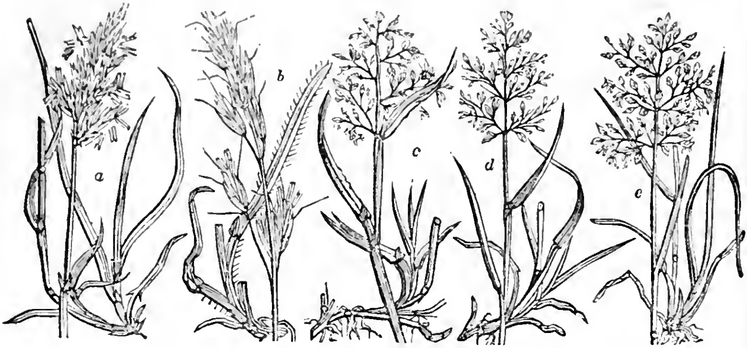
"The pasture grasses for poor or secondary soils are the *Cynosurus cristatus*, *Festuca duriuscula* and *ovina*, *Poa compressa*, *cristata*, and *angustifolia*.

"The grasses that afford most nutritive matter in early spring are the meadow foxtail grass and the vernal grass; the former has been already mentioned as one of the best hay grasses.

"The sweet-scented vernal grass (*Anthoxanthum odoratum*, *Fig.* 4, *a*) is common in almost all pastures, and is that which gives the fragrance to natural or meadow hay. It is chiefly valuable as an early grass; for, though it is eaten by stock, it does not appear to be much relished by them. From the Woburn experiments, it appears that the smallness of the produce of this grass renders it improper for the purpose of hay; but its early growth, and the superior quantity of nutritive matter which the latter-math affords, compared with the quantity afforded by the grass at the time of flowering, cause it to rank high as a pasture grass on such soils as are well fitted for its growth, lands that are deep and moist.

"The downy oat grass (*Avena pubescens*, *b*), according to the Woburn experiments, possesses several good qualities, which recommend it to par-

Fig. 4.



Early pasture grasses.

ticular notice; it is hardy, early, and more productive than many others which affect similar soils and situations. Its growth, after being cropped, is tolerably rapid, although it does not attain to a great length if left growing; like the *Poa pratensis*, it sends forth flower stalks but once in a season, and it appears well calculated for permanent pasture on rich, light soils.

"The annual meadow grass (*Poa annua*, *c*) is the most common of all grasses, and the least absolute in its habits. It is almost the only grass that will grow in towns. Though an annual grass, it is found in most meadows and pastures perpetually flowering, and affording an early sweet herbage, relished by all stock, and of as great importance to birds as wheat is to man. It hardly requires to be sown, as it springs up everywhere of itself. However, it may not be amiss to sow a few pounds of it per acre wherever perpetual pasture (not hay) is the object.

"The fine bent grass (*Agrostis vulgaris*, *d*) is one of the most common grasses, and, according to the Woburn experiments, one of the earliest. The *A. palustris* is nearly as early in producing its foliage, though both flower late, and neither is very prolific either in bulk or nutritive matter. *A. stricta* is the herd's grass of Virginia and the South.

"The narrow-leaved meadow grass (*Poa angustifolia*, *e*), though it flowers late, yet is remarkable for the early growth of the leaves. According to the Woburn experiments, the leaves attain to the length of more than twelve inches before the middle of April, and are soft and succulent; in May, however, when the flower stalks make their appearance, it is subject to the disease termed rust, which affects the whole plant, the consequence of which is manifest in the great deficiency of produce in the crop at the time the seed is ripe, being then one half less than at the time of the flowering of the grass. Though this disease begins in the straws, the leaves suffer most from its effects, being, at the time the seed is ripe, completely dried up: the straws, therefore, constitute the principal part of the crop for mowing, and they contain more nutritive matter, in proportion, than the leaves. This grass is evidently most valuable for permanent pasture, for which, in consequence of its superior, rapid, and early growth, and the disease beginning at the straws, nature seems to have designed it. The grasses which approach nearest to this in respect of early produce of leaves, are the *Poa fertilis*, *Dactylis glomerata*, *Phleum pratense*, *Alopecurus pratensis*, *Avena elatior*, and *Bromus littoreus*, all grasses of a coarser kind.

"The best natural pastures, examined carefully during various periods of the season, were found by Sinclair to consist of the following plants:

Alopecurus pratensis,	Avena elatior,
Dactylis glomerata,	Lolium perenne,
Festuca pratensis,	Bromus arvensis,
Phleum pratense,	Poa annua,
Anthroxanthum odoratum,	Avena pratensis.

"These afford the principal grass in the spring, and also a great part of the summer produce:

Avena flavescens,	Poa pratensis,
Hordeum pratense,	Holcus lanatus,
Cynosurus cristatus,	Trifolium pratense,
Festuca duriuscula,	Trifolium repens,
Poa trivialis,	Lathyrus pratensis.

"These yield produce principally in summer and autumn:

Achilea Millefolium,	Agrostis stolonifera and
Triticum repens,	palustris.

"The above mixture, sown at the rate of four or five bushels to the acre, on well-prepared soil, without corn or other crop of any kind, could hardly fail of producing excellent pasture in the following year, and for an indefinite period. The best time for sowing is July or August, as spring-sown seeds are apt to suffer with the droughts of June and July. Fifteen of the above sorts are to be had from the seed shops; and all of them may be gathered from natural pastures, or bespoke from collectors.

"Of late pasture grasses, the different species of cat's-tail (*Phleum*) and bent grass (*Agrostis*) are the chief, and especially the Timothy and fiorin grass. The grasses, Davy observes, that propagate themselves by stolones, the different species of *Agrostis*, supply pasture throughout the year, and the concrete sap stored up in their joints renders them a good food even in winter.

"Of pasture grasses for inferior soils, one of the most durable is the dog's-tail grass (*Cynosurus cristatus*, also called *Eleusine Indica*, Fig 5, *a*). This is a very common grass

Fig. 5.

Pasture grasses for inferior soils.

on dry, clayey, or firm surfaces. It is one of the best grasses for parks, being highly relished by the South Down sheep and deer.

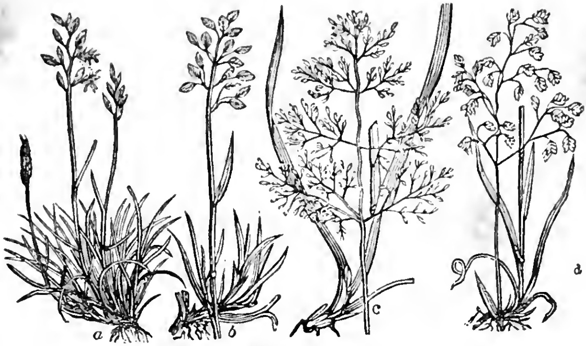
"The hard fescue grass (*Festuca duriuscula*, *b*) is one of the best of the dwarf sorts of grasses. It is grateful to all kinds of cattle; it is present in most good meadows and pastures, and, with *F. ovina*, is the best for lawns.

"The *Festuca glabra* (*c*) and *hordeiformis* (*d*) greatly resemble the hard fescue, and may be considered equally desirable as pasture and lawn grasses.

"The yellow oat grass (*Avena flavescens*) is very generally cultivated, and appears, from the Woburn experiments, to be a very valuable grass for pasture on a clayey soil.

"Of pasture grasses for inferior soils and upland situations, one of the principal is the *Festuca ovina*, or

Fig. 6.



Pasture grasses for poor uplands.

sheep's fescue grass (*Fig.* 6, *a*). This grass is peculiarly adapted for hilly sheep pastures. It is a low dwarf grass, but relished by all kinds of cattle. According to Sinclair's experience, 'on dry soils that are incapable of producing the larger sorts, this should form the principal crop, or, rather, the whole; for it is seldom or never, in its natural state, found intimately mixed with others, but by itself.

"The *Poa alpina* (*b*), *Alopecurus alpinus*, and *Aira cæspitosa* (*c*), *Briza media* (*d*) and *minima*, and *Agrostis humilis* and *vulgaris*, are all dwarf mountain grasses, well adapted for hilly parks or lawns."

The Bermuda grass, which grows so luxuriantly in the West and South, is propagated by roots only, as it does not flower in the latitudes where it is cultivated.

"On the culture of these grasses it is unnecessary to enlarge, as it must obviously be the same as that of rye grass or any of the others.

"The chief difficulty is to get the seed in sufficient quantity, for which a good mode is to contract with a seedsman, a year beforehand, for the quantity wanted. With all the pasture grasses, except the last class, we should recommend at least half the seed to be that of the perennial rye grass; and we think it should also form a considerable part of the seeds used in laying down all meadows, except those for the aquatic or stoloniferous grasses. These, if they thrive, are sure to choke and destroy it.

"The formation of grassy surfaces, by distributing pieces of turf over them, has long been practised in gardening, in levelling down raised or filling up hollow fences, and in other cases of partially altering a grassy surface." It is called inoculating grass.

Nutritiousness and yield of Grasses.—Mr. Sinclair, under the directions of the Duke of Bedford, established a long course of experiments to determine these points. These researches are now of no value in respect to the comparative nutritiousness, but are worthy of attention as giving the comparative yield on certain soils. The nutritiousness of grasses does not depend on the matters extractible by boiling, for fibrin and albumen are insoluble in water. Grasses do, however, differ considerably in this respect, as is shown by the ultimate analysis of some authors, which give 1·1 and 1·5 per cent. of nitrogen in different specimens. The former will represent seven, and the latter 9¾ per cent. of azotized or flesh-making constituents. The table opposite is mostly from Sinclair; the greater part of the grasses are either

TABLE SHOWING THE BOTANICAL AND COMMON NAME OF THE BEST GRASSES, THEIR DURATION, NATURAL SOIL, YIELD PER ACRE IN GRASS AT FLOWERING, IN SEED, AND AFTER-MATH IN POUNDS.

Botanical Name.	Common Name.	Height, inches.	Time of Flowering.	Natural Soil.	Yield. Pounds Flowering.	Yield. Pounds in Seed.	Yield. After-math.	Remarks.
Anthoxanthum odoratum	Sweet vernal grass	12	April	Good sandy loam	7,827	6,125	6,808	An early pasture grass.
Holcus odoratus	Sweet soft grass	14	April	Rich sandy loam	9,528	27,225	17,015	The best early flowering grass.
Poa alpina	Alpine meadow grass	6	April	Light sandy loam	5,445	—	—	A pasture and lawn grass.
Alopecuris pratensis	Meadow foxtail grass	24	May	Clayey loam	20,418	12,931	8,167	One of the best hay and meadow grasses.
Poa pratensis	Smooth stalked meadow grass Kentucky blue grass. *Var.*	18	June	Turf and clay	10,209	8,507	4,083	Good early pasture and hay.
Avena pubescens	Downy oat grass	18	June	Rich sandy loam	15,654	6,806	6,806	Good pasture on rich soil.
Festuca hordeiformis	Barley fescue grass	18	June	Manured sandy	13,672	—	—	
Poa trivialis	Roughish meadow grass	20	June	Manured light loam	7,486	7,824	4,764	A most valuable grass in rich, moist soils.
Festuca glauca	Glaucous fescue	12	June	Brown loam	9,528	9,528	—	A good hay grass.
——— ovina	Sheep's fescue	6	July	Light sandy loam	—	5,445	3,403	Good pasture and lawn grass.
——— duriuscula	Hard fescue	12	July	Light sandy loam	18,376	19,075	10,209	A good grass for hay or pasture.
——— pratensis	Meadow fescue	30	July	Bog soil	13,612	19,075	—	Excellent early hay grass.
——— loliacea	Spiked fescue	36	July	Rich brown loam	16,335	10,890	5,103	One of the most valuable for hay and pasture.
——— calamaria	Reed-like fescue	40	July	Clayey loam	54,450	51,046	—	Early and prolific.
——— elatior	Tall fescue grass Andes grass	36	July	Black rich loam	51,046	51,046	15,654	An excellent meadow grass.
——— fluitans	Floating fescue	18	July	Strong clay	13,612	—	—	An amphibious, good grass.
——— rubra	Purple fescue	12	June	Light sandy loam	10,209	10,890	3,103	Good sheep and lawn grass.
Dactylis glomerata	Cocksfoot grass Orchard grass	24	July	Rich sandy loam	27,905	26,544	11,910	Very productive, but coarse.
Poa angustifolia	Narrow-leaved meadow grass	24	July	Brown loam	18,376	9,528	—	Excellent hay grass.
—— fertilis	Fertile meadow grass	20	July	Clayey loam	14,973	—	—	An early grass.
—— aquatica	Reed meadow grass	72	July	Strong clay	126,596	—	—	Most prolific, but coarse.
Briza media	Quaking grass	16	June	Rich brown loam	9,528	9,528	8,167	Good pasture grass.
Lolium perenne	Perennial rye grass	24	July	Rich brown loam	7,827	14,973	3,403	Highly esteemed.
Cynosurus cristatus	Dog's tail grass	24	July	Manured brown loam	6,125	12,251	—	A good pasture grass.
Holcus lanatus	Meadow soft grass	24	July	Strong clay loam	19,057	19,057	—	Early and productive.
——— mollis	Creeping soft grass	30	Aug.	Sandy soil	34,031	21,099	—	A valuable grass.
Phleum pratense	Timothy Cat's-tail grass	24	July	Clayey loam	40,837	40,837	9,528	Excellent hay grass.
Hordeum pratense	Meadow barley grass	24	July	Manured brown loam	8,167	—	—	Early and nutritive.
Aira cæspitosa	Turfy hair grass	9	July	Strong clay	10,209	—	—	Excellent lawn and sheep grass.
Avena flavescens	Yellow oat grass	18	July	Clayey loam	8,167	12,251	4,083	A valuable grass.
Agrostis vulgaris	Fine bent grass Herd's grass	18	July	Sandy soil	9,528	—	—	An early grass.
——— stolonifera	Fiorin grass	24	Aug.	Bog soil	17,696	19,057	—	Useful on peat lands.

indigenous or cultivated in the United States.

All these grasses are perennial in a good soil, and a rich, permanent meadow for grass or pasture should contain several kinds. The amount of cured hay produced will be about one fifth of the grass cut. For farther particulars, see the *Grasses themselves*.

Specific Manures.—Grasses are remarkable for the amount of alkali (potash or soda) they contain, and if allowed to run to seed, are also rich in bone earth. Sprengel found in 1000 pounds of rye grass hay

Potash and soda	12·75 lbs.
Lime and magnesia	8·15 "
Sulphuric acid	3·50 "
Phosphoric acid	·25 "
Silica	27·70 "
Chlorine, iron, &c.	·40 "
	52·75

This specimen must have been made from grass before flowering. From this composition, we learn that fresh ashes (leached ashes on sandy soils), bone earth, gypsum, and occasional top-dressing, with air-slacked lime, are appropriate manures. Nitrogen manures, applied to grass crops, are, in some measure, wasted from their exposure. Soluble silicate of soda and potash has been used on grass with advantage. The green marl of New-Jersey will, in part, answer this purpose on stiff soils.

GRASS LAND. "This may be divided into water meadows, upland pastures, and artificial grasses. The first are treated of under *Irrigation:* the nature and management of the last two we shall here briefly describe. Upland pastures are portions of land on which the natural grasses grow spontaneously, varying in quantity and quality with the soil and situation. The plants which form the natural sward are not confined to the family of true grasses, but many other plants, chiefly with perennial roots, form part of the herbage. In the richest soils the variety is exceedingly great. When a sod is taken up, and all the plants on it are examined, the species will be found more numerous than we should have believed possible;* and in the same ground the plants will vary in different years, so as to induce one to conclude, that, like most other herbaceous plants, the grasses degenerate when they have grown for a long time on the same spot, and that a kind of rotation is established by nature. It is chiefly in those pastures where the grasses are allowed to grow till they form their seed that this is observable; for when they are closely fed, and not allowed to shoot out a seed stem, they are less subject to degenerate and disappear. This may be a reason why experienced dairymen are so unwilling to allow their best pastures to be mown for hay. They pretend that the feed is deteriorated in the next year, and that inferior grasses are introduced which injure the quality of their butter and cheese. Close feeding is always considered as the most advantageous, both to the cattle and the proprietor.

"The only way in which a pasture distant from cities can be profitable, is by feeding stock; and its value is in the exact proportion to the number of sheep or cattle which can be fed upon it in a season. Extensive pastures are often measured only by their capacity in this respect.

"When a pasture is naturally rich, the only care required is to stock it judiciously, to move the cattle frequently from one spot to another (for which purpose, enclosures well fenced are highly advantageous), and to eradicate certain plants which are useless or noxious, such as docks and thistles, alder, broom, briars and thorns, which, not being touched by the cattle as long as they have better food, would increase and overrun the ground, and take up a space which would be more profitably occupied by good herbage. The dung of the cattle, also, when left in heaps as it is

* In a sod of grass the following plants were found: Plantago lanceolata, Agrostis capillaris, Avena flavescens, Dactylis glomerata, Festuca duriuscula, Poa annua, Cynosurus cristatus, Trifolium repens, Crepis tectorum, Achillea millefolium, Galium verum, Hypochæris radicata, Hieracium pilosella, Thymus serpyllum —(Curtis *on Grasses.*)

dropped, kills the grass and introduces coarse and less palatable plants. All that is required in rich pastures in which cows and oxen are fed, and which are properly stocked, is, to prevent the increase of the coarser and less nutritive plants. Weeding is as important in grass as in arable land; and if it is neglected, the consequence will soon be observed by the inferior quality of the feed. The urine of the cattle is the manure which chiefly keeps up the fertility of grass land; and although in hot and dry weather it frequently burns up the grass where it falls, when it is diluted by showers, the improved appearance of the surface shows that its effect has not been detrimental. To enrich poor meadows there is no manure so effective as diluted urine, or the drainings of stables and dunghills.

"When pastures are poor, and the herbage is of a bad quality, the cause is to be sought for in the soil. A poor arid soil is not fitted for grass, nor one which is too wet, from the abundance of springs and the want of outlet for the water. These defects can only be remedied by expensive improvements. A soil which is too dry may be improved by cultivation and judicious manuring; but for this purpose it must be broken up and treated for some time as arable land; and it may be a question whether or not the expense of improving the soil will be repaid by the superior quality of the pasture when it is again laid down to grass. In general, the poor light soils, if they are worth cultivation, answer better as arable land, especially where the root husbandry is understood. The low wet clay soils may be converted into good pastures by draining them well; and the improvement thus produced is so great, that judicious draining in such soils is the most profitable investment of capital.

"When old meadows have been neglected, or too often mown, without being recruited by manure or irrigation, they are often overrun with moss or rushes, and produce nothing but a coarse grass. In that case, besides draining it, if required, the land must be broken up and undergo a regular course of tillage, until the whole of the old sward is destroyed and a better collection of grasses cover its surface. If this be done judiciously, the pasture will not only be greatly improved in the quality, but also in the quantity of the grass. There is a natural prejudice against the breaking up old grass land; this has arisen from the improper manner in which it is frequently effected. The sward, when rotten, is a powerful manure, and produces great crops of corn. These tempt the farmer to repeat the sowing of corn on newly broken up lands. The fertility is reduced rapidly; and when grass seeds are sown after several crops of corn, the soil has been deprived of a great portion of the humus and vegetable matter which is essential to the growth of rich grass. The proper method of treating grass land, broken up to improve it, is to take no more corn crops than will pay the expense of breaking up, carting lime, or other substances upon it to improve the soil, and to lay it down to grass again as soon as the old sward is fully destroyed.

"If the soil be fit for roots, no better crop can be sown to prepare for the grass seeds, which should be sown without a corn crop, except where the sun is powerful, and the seed is sown late in spring; but autumn is by far the best season for sowing grass seeds for permanent pasture. Turnips of an early kind may be sown in May, and fed off with sheep in August or September; and the ground being only very slightly ploughed, or, rather, scarified and harrowed fine, the seeds may be sown and rolled in. The species of grasses sown must depend on the nature of the soil; but it is impossible to be too choice in the selection. That mixture of chaff and the half-ripe seeds of weeds, commonly called hay seeds, which is collected from the stable lofts, should be carefully rejected, and none but seeds ripened and collected on purpose should be sown. The *Trifolium repens* (white clover), the *Trifolium medium* (cow grass), *Medicago lupinula* (trefoil), *Lolium perenne* (rye grass), the poas and festucas, are the best kinds of grasses. A very easy way of obtaining good seed is to keep a piece of good meadow shut up from the cattle early in spring, carefully weeding out any coarse grasses, and letting the best arrive at full maturity; then mow and dry the crop, and thrash it out upon a cloth. This will give the best mixture of seeds; but some of the earliest will have been shed, and these should be collected separately, or purchased from the seedsmen. Before winter the ground will already be covered with a fine green, if the seed has been plentiful. The quantity per acre of the mixed seeds should not be less than 30 or 40 pounds to ensure a close pile the next year. If the soil is not naturally rich, liquid manure, or urine, diluted with water, should be carried to the field in a water-cart, and the young grass watered with it; this will so invigorate the plants, that they will strike and tiller abundantly. They should be fed off by sheep, but not too close. The tread of the sheep and their urine will tend to make the pile of grass close, and the year after this the new pasture will only be distinguished from the old by its verdure and freshness.

"The fertility produced by grass which is fed by cattle and sheep has given rise to the practice of converting arable land to pasture for a certain time in order to recruit its strength. The old notion was that the land had *rest*, which by a confusion of ideas was associated with the rest of the labourers and the horses. The land, by being in grass, has much vegetable matter added to it from the fibres of the roots which die and decay, as well as from the other parts of the grass, which draw nourishment from the atmosphere and impart it to the roots. Thus, in time, an accumulation of humus is formed; and when the land is ploughed, the rotting of the sward greatly increases it. Every species of plant thrives well in this improved soil; and the vigour of the growth is ascribed to the recruiting effects of rest, by a fancied analogy with the animal muscle, which is invigorated by occasional inaction.

"But it is well known that land which has been some years in grass is improved in fertility. The convertible system of husbandry takes advantage of this fact; and all its art consists in reproducing a good pasture without loss of time, after having reaped the benefit of the fertility imparted to the land during three or four years when it was in grass. Good pasture is very profitable; so are good crops: by making the one subservient to the other, the farmer who adopts the convertible system is enabled to have a better profit than those who adhere to a simple rotation of annual crops.

"When an arable field is sown with the seeds of grasses and other plants which give herbage for cattle, it is called an artificial meadow, and the various plants which are raised are all called artificial grasses, although many of them have no botanical title to the name of grass, such as clover, sainfoin, lucern, and many others, which produce the best pastures and the finest hay.

"In laying down a field to grass for a very few years, the mode of proceeding is somewhat different from that which is recommended for producing a permanent pasture. Clover in this case is always a principal plant, both the red and the white; these, with annual or perennial rye grass, are sown with a crop of oats, &c., in spring, and begin to show themselves before harvest. The grasses are often mown the first year after they are sown, on account of the abundance and value of the red clover, but the best farmers recommend depasturing them with sheep, to strengthen the roots and increase the bulk. Various circumstances, such as a greater demand for clover hay, or for fat cattle, may make mowing or feeding most profitable; but when there is not a decided advantage in making hay, feeding should always be preferred. At all events, the great object of the farmer should be to have his land in good heart and tilth, and free from weeds, when the grass is sown. If his grass be good, he is certain of good crops after it, with little trouble or manure."

The seeds to be sown on an acre, when the land is laid down to grass, are as follows: Red clover, eight pounds; Timothy, two pecks; Kentucky blue grass, five pounds; white clover, six pounds, or orchard grass, two pecks; rye grass, two pecks, may be introduced. This is for a field intended to remain four or five years in grass.

"The introduction of artificial meadows in districts where the soil seemed not well adapted for pasture has greatly increased the number of cattle and sheep reared and fattened, and has caused greater attention to be paid to the means of improving the breeds of both. Thus a double advantage has arisen: the public is benefited by an increased supply, and the farmer is rewarded by an additional source of profit.

"In the neighbourhood of large towns there are many meadows, which, without being irrigated, are mown every year, and only fed between hay harvest and the next spring. These require frequent manuring to keep them in heart, and with this assistance they produce great crops of hay every year. Sometimes the meadows are manured with stable dung which has been laid in a heap for some time, and been turned over to rot it equally. This is put on soon after the hay is cut, and the rains wash the dung into the ground; but if a very dry and hot summer follows, little benefit is produced by the dung, which is dried up, and most of the juices evaporated. A better method is to make a compost with earth and dung, and, where it can be easily obtained, with lime. The best earth is that which contains most vegetable matter; and as many of these meadows are on a stiff clay soil, which requires to be kept dry by open drains and water furrows, the soil dug out of these and carted to a corner of the meadow makes an excellent foundation for the compost. It is sometimes useful to plough furrows at intervals to take off the superfluous surface water in winter; the earth thus raised by the plough is excellent to mix in the compost; having been turned over with dung, sweepings of streets, or any other manure, so as to form a uniform mass, it is spread over the land in winter; and in spring a bush-harrow is drawn over the meadow, and it is rolled with a heavy roller. When the meadow is moss bound, or of a light soil, it may be dressed with the clod crusher (roller) or with a weighted harrow. All this compost is soon washed into the ground, and invigorates the roots of the grass. It is better to put on a slight coating of this compost every year than to give a greater portion of manure every three or four years, as is the practice of some farmers. The grazing of cattle has generally been a more profitable occupation than simply tilling the land. The capital required is considerable, but the current expenses are not great. The grazier is not subject to such total failures as the farmer of arable land is in his crops. With a little experience and prudence, he can always reckon on a certain return. An acre of good grazing land is supposed to produce 200 pounds of meat in the year. By uniting the raising of corn and the grazing of cattle and sheep, the greatest profit is probably obtained, and this is the great argument in favour of the convertible system of husbandry."

The foregoing is principally from the Rev. W. L. Rham.

GRASSHOPPERS. The popular name of the genus *Gryllus*, or locusts. They are, for the most part, devourers of herbage, numerous species living on grass and the leaves of trees. The method of destroying the common meadow grasshoppers is, to manure the grass immediately after cutting, and while the young insects are abundant, with air-slacked lime, gas-house liquor, salt, a watering of whale oil soap, and similar bodies, taking care not to destroy the herbage.

GRAYWACKE. Gray rock. An old geological term for the gray transition rocks; as gneiss, mica, slate, &c.

GRAVEL. A geological formation or soil, consisting of rolled pebbles, loosely interspersed, more or less abundantly, in a sandy or clayey medium. It is of every degree of fineness, chemical composition, and value in farming. Those gravels containing silicious pebbles chiefly, and of a large size, are nearly unfit for tillage, and the value increases with the presence of slates, granites, hornblende, mica, marl, and clay. They are usually very porous, draining water off rapidly, and cannot be of much value, unless incumbent on a subsoil that holds water at some little depth. If the gravel be fertile, it is usually warm and best adapted for roots. Stiff marls, burned clay, and an abundance of vegetable matter are to be used as manures.

Gravel is well adapted for forming walks in gardens and the surface of roads.

GRAVEL. In farriery, the formation of hard calculi or stones in the bladder, or of a sandy sediment.

GRAVEOLENT. Fetid, having a strong odour.

GRAVES, GREAVES. Membranous matter left as refuse by the tallow-melter; it is used for feeding dogs, and given to poultry. Graves contains a large amount of fat, and is admirably adapted for fattening hogs, &c.; it has been used, also, as a manure; 200 pounds interspersed in stable manure may be added to the acre; but the most economical plan will be to compost it in the nitre bed. It is a nitrogen manure, 100 pounds yielding about 13 pounds of ammonia, and being equal, in this respect, to 1½ tons of farm-yard manure. The presence of sulphur and phosphorus, besides bone earth, also constitute it a manure applicable to all rich crops; as corn, wheat, tobacco, &c., the only consideration being the economy of using so high-priced an article. See *Manures*.

GRAVID. Pregnant.

GRAVIMETER (from *gravis, heavy*, and *μετρον, a measure*). See *Hydrometer*.

GRAVITATION, GRAVITY. The tendency that masses have to approach each other; also called *attraction of gravitation*. The *gravity* of a body is therefore the attraction it extends towards other bodies; it increases with the bulk, density, and nearness of bodies, being directly as their density and mass, and inversely as the squares of their distances. *Weight*, and the descent of all bodies towards the earth's surface, is an effect of the earth's gravity, or *terrestrial gravitation*.

GRAVITY, SPECIFIC. The ratio of the weight of any solid or liquid to the weight of an equal bulk of pure water at 62° Fahrenheit. The specific gravity of gases is the ratio to the weight of an equal volume of air at the same temperature. If the solid be lighter than water, the measurement is made more indirectly.

How taken.—The specific gravity of solids is taken by first weighing a piece in air, and then weighing it immersed in pure water, and dividing the weight in air by the loss of weight in water. *Fluids* are examined either by filling a bottle known to contain precisely 1000 grains of pure water, up to a certain mark, and setting down the weight, irrespective of that of the bottle, as the specific gravity. This is called the 1000 grain bottle. Or an instrument called a *hydrometer*, *gravimeter*, or *areometer* is immersed in the fluid, and sinks to a certain mark, which indicates the specific gravity or density (see *Hydrometer*). The gravity of gases is taken by first exhausting a glass vessel of air by the air pump, and then introducing the particular gas, the weight of which, irrespective of the glass, will be the second proportional of the following series: As the weight of air is to that of the gas, so is 1 to the specific gravity of the gas; that is, the weight of the gas divided by that of the air gives the specific gravity. This operation is, however, of great delicacy, for the gases must be perfectly dry.

The following numbers indicate the specific gravities of several useful bodies:

Acid, muriatic	1·200	Marble	2·716	Oil, whale	0·923
——, nitric	1·271	Metals:		Slate, drawing	2·110
——, ——, strongest	1·583	Copper	8·900	Spermacti	0·943
——, sulphuric	1·850	Gold	19·361	Sugar	1·606
Alcohol, absolute	0·797	Cast iron	7·248	Sulphur	1·990
Ammouia, solution	0·875	Lead	11·352	Wax	0·964
Butter	0·943	Mercury	13·598	Woods:	
Copal	1·045	Sheet platina	22·069	Apple	0·793
Diamond	3·521	Potassium	0·865	Ash	0·845
Æther	0·632	Silver	10·510	Beech	0 852
Fat of beef	0·923	Steel	7·816	Box	1·328
Glass, crown	2·520	Tin	7·291	Campeachy	0 913
——, flint	2·760	Zinc	7·191	Cedar	0·596
Granite	2·613	Milk	1·032	Cherry-tree	0·715
Gypsum	2·288	Nitre	1·900	Ebony	1·331
Honey	1·450	Oil, turpentine	0·870	Elm	0·671
Indigo	1·009	——, almond	0·932	Pine	0·550
Ironstone	3·573	——, hemp	0·926	Lignum vitæ	1·333
Ivory	1·825	——, linseed	0·940	Poplar	0·383
Lard	0·947	——, olives	0·915	Yew	0·788
Limestone	2·386	——, rape	0·913		

GRAY DYES. These are usually light blacks. *Ash gray* is given to 30 lbs. wool by 1 lb. gall nuts, ½ lb. crude tartar, and 2½ lbs. green vitriol. Proceed as in dyeing blacks, in 80 lbs. water. *Pearl gray*, prepare the first bath with sumach, with half logwood. Fustic gives a yellowish or brown gray.

GRAZIER. A person engaged in raising and fattening cattle. For the practice of this business in the Eastern and sea-board States, great judgment is now become necessary, from the facilities for grazing enjoyed by the Western States. The following, chiefly from the "*Complete Grazier*," is worthy of attention:

"A man should know how beasts ought to be formed; should have a quick eye for selecting those with a frame that is likely to produce weight; and a hand that should feel the known indication of the probability of soon becoming fat.

"An acre produces from 200 to 300 pounds of flesh annually in good grass. In the opinion of the most intelligent graziers, in stocking enclosures, the cattle should be divided in the following manner: Supposing four fields, each containing a nearly equal quantity of land, one of them should be kept entirely free from stock until the grass is got up to its full growth, when the prime or fatting cattle should be put into it, that they may get the best of the food; the second best should then follow; and after them either the working or store stock, with lean sheep to eat the pastures close down; thus making the whole of the stock feed over the four enclosures in this succession:

"No. 1. Clear of stock, and reserved for the fattening beasts.

"No. 2. For the fattening beasts, until sent to No. 1.

"No. 3. For the second best cattle, until forwarded successively to Nos. 2 and 1.

"No. 4. For stores and sheep to follow the other cattle; then to be shut up until the grass is again ready, as at No. 1, for the fattening beasts.

"By this expedient the fattening cattle will cull the choicest parts of the grass, and will advance rapidly towards a state of maturity; for they should always have a full bite of short and sweet grass, and with such cattle the greatest care should be taken not to overstock the enclosures. It is also advisable to divide the fattening enclosure by fences, so as to confine the beasts within one half of it at a time, and to allow them the other half at the other, so that they may continually have fresh pasture.

"Shade and pure water are essentially necessary, and where there are no trees, rubbing-posts should be set up to prevent the cattle from making that use of the gates and fences. In marsh land, which is chiefly divided by ditches, this, indeed, should never be neglected, as it is materially conducive to their comfort."

GREASE. For carts, a mixture of tar with refuse lard, butter, or fat is commonly employed. Twenty parts plumbago powder and eighty fat form a good grease for this purpose.

GREASE IN HORSES. See *Horse.*

GREAVES. See *Graves.*

GREEN CROPS. Such crops, roots, &c., as are fed off the land or used in soiling, before becoming ripe and fit for storage. When ploughed into the ground, they form green fallows.

GREEN DYE. This is produced, in all its shades, by using a bath of blue, and then yellow.

GREEN FALLOW. Green crops ploughed into the soil.

GREEN GRASS. Probably *Poa angustifolia.* An early and late pasture grass, much esteemed in the Eastern States. It bears water well, but is occasionally subject to rust. See *Grasses.*

GREEN-HOUSE. A conservatory. This should be distinguished from a hot-house, in which artificial heat is used. It is covered with glass either on one or both sides; if on one only, that should have a southern aspect. Plants are stored here in pots or frames, fruit-trees trained against the wall, and the roof partially covered with grape-vines. They are used to protect tender plants from winter, and advance the ripening of fruits. An *Orangery* is a place of deposite for orange and other trees set in pots, which produce their shoots in summer, and are then transferred to the open air. It does not always have a glass roof, but is frequently a pit dug in the soil on a hill-side, and covered, the south side of which only is glazed. In very severe weather the glass of the green-house may be covered with mats.

GREEN MANURES. Manures ploughed into the land in a fresh or green state, especially green fallow crops. The principal plants used for this purpose are clover of various kinds, buckwheat, grasses, oats, rye, tares, various beans, lupins, spurry, borage, and turnips running to flower: young Indian corn, mustard, and, indeed, nearly all herbage the seeds of which are not too expensive, have been proposed.

But there are two points worthy of consideration in the use of these plants: 1st. That some improve the soil much more rapidly than others, viz., clovers, grasses, spurry, and buckwheat. 2d. That an excess of green matter turned into the soil is disadvantageous, bringing on a tendency to mildew; it is best, therefore, to scatter lime over a green fallow, harrow it in, and sow the seed within a few weeks, unless the soil is very stiff; for the gaseous matter given out by the decomposition of the manures will be serviceable to plants, and should not be lost. In stiff soils make the fallow in the fall.

By this means lands are very rapidly brought up if they are merely deficient in vegetable matter; the expense is also much less than by the accumulation and spreading of other manures. Sea-weeds, weeds cropped from the soil, &c., are also called green manures when ploughed into the soil in the fresh state. Some writers use the term green manure for long or unfermented dung.

GREEN SAND. *New-Jersey marl.* One of the upper secondary deposites of geologists, consisting, for the most part, of a sandy formation, the grains of which are, however, much softer than those of common sand, and consist of silicate of iron chiefly; they are of several colours, from greenish gray to deep green and olive. It is extensively developed in the United States, being found in the valley of the Connecticut, southeastern portion of New-Jersey, Delaware, and Virginia.

Some portions of this deposite contain from 7 to 12 per cent. of potash combined with the silicate of iron.

This is particularly the case with that in Monmouth and Burlington counties, New-Jersey, and Newcastle county, Delaware. Numerous pits are, therefore, opened for the purpose of reaching this deposite, called *Marl*, which has been found, in many instances, to produce remarkable fertility when applied at the rate of 200 to 300 bushels on stiff clayey lands. In selecting specimens, we are to examine the amount of green sands in it, the fertility depending upon them; for the clay, common sand, and other impurities are of little importance. The richest kinds are of a deep green internally, sometimes with an olive tint, but the exterior becomes grayish and covered with a slight efflorescence; it is also readily crushed. The following analysis of a specimen from Monmouth county will give the particulars of its composition per cent.:

Silica	50·00
Alumina	7·00
Protoxide of iron	22·00
Potash	11·00
Lime	1·00
Magnesia	a trace
Water	9·00
	100·00

The potash here is combined with silica, but their union is readily destroyed by the carbonic acid of the soil, which rapidly forms carbonate of potash.

This manure is peculiarly applicable to grass, oats, wheat, corn, and the *Cerealia* generally; it will also be serviceable to roots growing on a stiffish soil. It may not, however, pay the expenses of long transportation, a small quantity of ashes replacing it in the compost heap.

GREENSTONE. A species of trap consisting of feldspar and hornblend. It is a fused and intruded rock.

GREEN VITRIOL. Sulphate of protoxide of iron. It is styptic, emetic, and much used in dyeing and ink-making.

GREYHOUND. A coursing dog, remarkable for his swiftness and symmetry.

GREYWACKE. *Grauwacke.*

GRIP. A small drain.

GRIPES. Colic. See *Horse* and *Ox*.

GRIT. A hard sandstone, usually coarse, used for mill-stones and pavements.

GROATS, or GRITS. Oats prepared by hulling.

GROIN. In architecture, the junction of two arches.

GROSSULARIA. The generic name of the currant and gooseberry.

GROUND-BAIT. Balls made of grain, graves, bran, lentils, mixed with clay, and thrown in those parts of a pond or river where angling is carried on.

GROUND-CHERRY. Several varieties of *Physalis*, a weed.

GROUND-NUT. *Apios tuberosa.* A leguminous plant, with a perennial root, bearing small tubers of one half an inch, which are esculent. It is indigenous in the Middle States, and has been recommended for culture. For the common ground-pea, see *Pindars*.

GROUNDSEL. The genus *Senecio*: composite plants, annual, bitter, and purgative.

GROUT. In building, mortar made fluid with water. Plaster used for finishing walls. Mortar used in fixing foundations.

GRUBBER. A strong hoe for tearing up the roots of shrubs and trees.

GRUBS. Worms, maggots. The pupa of earth worms. They often infest new lands, and are to be remedied by heavy liming, a dose of salt of fifteen bushels to the acre, and frequent stirring and exposure of the soil to frost.

GRUIDÆ. Birds which wade like the crane (*grus*).

GRYLLIDÆ. A family of locusts, resembling the *Gryllus*.

GUAIACUM. A resin obtained from the *Guaiacum officinale*, a West Indian tree. It is little used in medicine for rheumatism.

GUANO. The changed dung of sea-fowl, of a brown colour and urinous smell, collected on islands off the coast of Peru and Southwestern Africa. Its composition differs: thus, by my analysis, made for the American Agricultural Association of New-York, the Peruvian contains,

Uric acid	10·5
Ammonia	19·0
Phosphoric acid	14·0
Lime and magnesia	16·0
Salts of soda and potash	6·0
Oxalic acid, with carbonic and muriatic acids	13·0
Water	13·0
Sand	2·0
Volatile and organic matters	6·5
	100·00

The African, from Ichaboe,

Ammonia	13·5
Humic acid	4 0
Phosphates	25·0
Oxalic, &c., acids	20·0
Salts of soda, &c.	7·0
Water and volatile matter	27·5
Sand	3.0
	100·00

These examinations indicate fair samples: the African seldom contains uric acid, and is therefore inferior, especially in the permanence of its effects. Uric acid, in its decay, produces carbonates of ammonia. The African is, however, most soluble, and acts rapidly. The specimens are to be valued by the amount of ammonia they yield in decay. Guano sells at from $35 to $50 the ton, and is now somewhat extensively used.

The African being soluble to the extent of 40 per cent., is better adapted for watering plants, and where very rapid growth is wanted. The Peruvian, on the other hand, acts for a longer time, and is better calculated for crops which continue to grow vigorously during many weeks. The two will probably produce very similar effects for one crop; but the Peruvian is much more active on the second crop.

Crops to which it may be applied.—It is hardly necessary to state that the application may be made to every crop, for experiments are already multiplied with nearly every common plant or tree: to enumerate a few is sufficient. Wheat, corn, grass, the cerealia, sugar-cane, tobacco, coffee, apple, pear, and other fruit trees, flowers, cabbages, turnips, and other cruciferous plants; the experiments are fewest on leguminous plants. But the effect of guano will not be equal on all; for those plants requiring most stable manure, such as tobacco, turnips, and corn, are more benefited than grass, oats, or such as require less, the chief effect of the manure being due to the quantity of the ammonia it contains. The reason guano is serviceable to all plants arises from its containing every saline and organic matter they require as food.

Kinds of Soil to which it may be applied.—It is used beneficially on all soils; for, as it contains every element necessary to plants, it is independent of the quality of the soil—*one great point* being attended to, that the land be in *good tilth;* for otherwise the tender roots of the vegetable find an obstruction to free growth, and are crippled. Poor, well-tilled soils exhibit most increase by guano, for in them some essential to the growth of plants is more likely to be absent.

Amount to be applied.—On wheat 250 pounds per acre will be an average for a fair soil, 300 pounds per acre for one that is poor, and 200 for a good soil. Corn, potatoes, turnips, cabbages, and garden vegetables will require 300 pounds on fair lands; but the amount may be diminished by 50 pounds if two applications are made instead of one. For grass, rye, and oats 200 pounds will be enough.

Time and Mode of Application.—Seeds may be prepared by soaking in a solution of a quarter of a pound of guano to the gallon of water, and this will answer for a first manuring, if they are left sufficiently long to exhibit signs of germination. Wheat and other small grains should be steeped in this solution about sixty hours, corn about one hundred hours. Thus steeped, the seeds of smut will also be destroyed. Half the quantity to be used when the plant has fairly started, and is in second leaf. By this timely addition, the effects of many insects are avoided, and the seedling at once takes on a robust habit. The remaining half should be applied to the small grain crops when they are throwing out new stems, or tillering; to corn, as the tassel appears, or at the second hoeing, and so with other hoed crops. This application should be made, therefore, at the latest period of working, and as nearly before flowering as practicable. The guano should be sowed with a mixture of fine soil, gypsum, or charcoal, to give it bulk, and divide the particles. No lumps should be thrown among the plants, for they burn them; and where an extensive application is to be made, it is better to screen the manure and pound the lumps. In sowing, reach the soil, if possible, for it is unserviceable to sprinkle it on the plants, and frequently destroys them. Select a season when the land is wet or moist, or when rain may be expected, for in dry weather the guano does not answer well, or even does injury. But if the crop suits, always prefer manuring the plant or hill; do this while hoeing; less guano is thus used, and more certain effects result. One tablespoonful to the hill of corn, tobacco, potatoes, &c., is an abundance for each application. If a solution be preferred, mix one pound in ten gallons of water, and water sparingly with this on the soil, and not *on the plants*, at the times before mentioned, taking care to stir up the insoluble portion when applied. For this purpose, the African variety will be most suitable; or, where rapid growth is wanted, irrespective of seed, the clear solution may be applied, the insoluble matter (phosphates, &c.), being reserved for wheat and corn. Guano may be composted with common soil, or anything but *lime* and *unleached ashes*, for these liberate the free ammonia, and thus diminish the effects of the manure.

Value, compared with other Manures.—So far as the experiments in England and Scotland may be adduced, one cwt. of guano is equal to about five tons of farm-yard manure on an average; but it is much higher for turnips than for grass, &c.

GUDGEONS. "In machinery, the pins inserted in the extremities of a shaft, or the axle of a wheel, on which it turns, and which support the whole weight. In order to diminish friction, gudgeons are made as small as possible in diameter, leaving, however, sufficient strength to support the weight. They are frequently formed of cast iron, on account of its cheapness; but wrought iron of the same dimensions is considerably stronger, and will support a greater load."

GUINEA CORN. Egyptian corn? Indian corn.

GUINEA FOWL. See *Poultry.*

GUINEA GRASS. JAMAICA GRASS. *Panicum polygamum.* A valuable perennial grass, thus denominated, as it was first discovered on the coast of Guinea. It was brought to Jamaica, where it is now extensively cultivated, and forms the means by which so much cattle is raised there. It grows from four to six feet high. Cattle eat it, both in a fresh and dry state, with great avidity.

"In spring," says Mr. Lawrence, of South Carolina, "I procured from Jamaica three half pints of Guinea grass seed, which I planted in the drills of one fourth part of an acre of very indifferent land; the seed sprung up and soon covered the ground with grass four feet high and upward. Being desirous of saving as much seed as possible, I cut one bundle of grass for the horses: they ate it all with great avidity.

"In August I took one of the grass roots and divided it into twenty-eight parts, which were immediately replanted: every part took root, and the whole are now growing very finely and seeding. I am of opinion this grass will make the best pasture we can wish for. From former experience, I have reason to believe the Guinea grass is perennial. It is easily managed, requires but one good hoeing, after which it will take care of itself."

GUINEA PEPPER. Common red pepper. *Capsicum annuum.*

GUINEA PIG, or CAVY. *Cavia cobaya.* A small rodent animal of six or seven inches in length, light colour, and herbivorous; a native of South America. It is considered a delicacy in Italy; the skin is also valuable. The female brings forth from ten to fourteen young at a litter, carries young three weeks, and bears every two months in warm weather. They are very cleanly, and cannot endure cold.

GULA. The region of the throat nearest the lower jaw.

GUM. A concrete juice, the product of most vegetables. There are many varieties, all reducible to two kinds: soluble, or *true gums*, which dissolve in water, forming mucilage, and are insoluble in alcohol; and insoluble, or tragacanth gums, which soften and swell in water, but are not soluble. It consists of C_{12} H_{10} O_{10}, and is readily converted into grape sugar by the action of dilute sulphuric acid. It is an aliment similar to sugar and starch, serving to sustain animal heat, and probably to produce fat. It so nearly resembles starch that has been heated until slightly brown, that the difference between them in physical qualities is scarcely apparent. The yolk of wool is sometimes called gum. See *Yolk*.

Fruit-trees often exude gum: this is considered a disease, and may arise from the punctures of insects; but, according to some, is also an indication of a poor soil, requiring putrescent manures. Various names, as *Bassorin*, *Arabin*, *Cerasin*, &c., are given to specimens of gum from different trees.

GUM RESIN. A concrete juice, obtained in various ways from plants, partly soluble in water, and partly in alcohol, as gamboge, aloes.

GUNNEY BAGS. Coarse sackcloth, made in the East Indies for packing.

GUTTA SERENA. Blindness without loss of transparency in the eye.

GYMNOCARPI (from γυμνος, *naked*, and καρπος, *a fruit*). The second division of Persoon's *Fungi*, including those that have their sporules in an exposed dilated membrane or hymenium, as *Agaricus*, *Boletus*, *Helvella*.

GYMNOSPERMIA, GYMNOSPERMS (from γυμνος, and σπερμα, *a seed*). Plants having naked seeds; at present this feature is said to be peculiar to the *Coniferæ* and *Cycadeæ*. Linnæus erroneously made it an order of *Didynamia*. The seeds of gymnosperms are, in truth, situated in carpels imperfectly closed, the aggregate of which forms the cone.

GYNANDRIA (from γυνη, *a woman*, and ανηρ, *a man*). A Linnæan class, in which the stamens and pistil are consolidated into a column. It consists principally of the *Orchidaceæ*.

GYNOPHORE (from γυνη, and φερω, *I bear*). The stalk on which some ovaria are elevated, as in the passion flower.

GYPSUM. Native sulphate of lime, found chiefly in the tertiary and new red sandstone. It occurs crystalline, fibrous, and massive. Common plaster of Paris consists of lime, 33; sulphuric acid, 46; and water, 21 per cent.; it is soluble in 400 parts water. By heating to redness, the water is partly driven off, but the sulphate is unchanged; the heated or boiled plaster is used as cement for plastering and moulding; it is objectionable in agriculture, from setting as a hard crust upon moist stems or leaves. The ground plaster is used extensively in husbandry, and is very advantageous to clovers, beans, lucern, and leguminous crops generally; on turnips and cabbages it is also serviceable. The dose is from one to five bushels, scattered broad-cast in the morning or evening upon growing plants soon after cropping, &c. It does not seem to answer on natural meadows, cerealia, umbelliferous, or chenopodaceous plants, or on wet places, very poor lands, or near the seacoast. It is most serviceable on new and manured soils.

Gypsum powder is extensively used in composts in stables, putrescent manures, and urine tanks, as it absorbs and fixes some portion of the volatile ammonia, converting it into the sulphate; it is not, however, so good for these purposes as green vitriol.

Gypsum undoubtedly acts chiefly by supplying plants with sulphur, as was suggested by Davy. M. Boussingault, however, seems to believe that it does no more good than the same amount of mild lime. It is not of itself a specific manure for all soils, but is serviceable from the general poverty of lands in sulphur. Ashes of peat and other plants contain from three to five per cent. of sulphate of lime.

GYRATE. Twisted round in circles. *Gyrate æstivation.*

GYRI (from *γυρος, a circle*). The annular series of scales on the tails of some quadrupeds.

GYROGONITES. Fossil seed-vessels of *Characeæ.*

H.

HABITAT. In natural history, the natural abode of animals, plants, &c.

HACK. The roadster, or horse of all work.

HACKBERRY, HAGBERRY. *Celtis crassifolia.* A tree chiefly abundant in the central Western States, also called hoop-ash. In Delaware and the Middle States it is not a large tree, but in Ohio sometimes attains eighty feet. The wood is white, but soft, light, and decays rapidly: it is used for fences in Ohio and Kentucky. The Indians use it for baskets. It is of very rapid growth.

HACKLE. A board set with iron spikes for pulling to pieces hemp or flax. An artificial fly used by anglers.

HACKMATACK. The American larch. There are two species (*Larix pendula* and *L. microcarpa*). They are principally found in Canada and Newfoundland, but exist scattered in the Northern and Eastern States. They are so nearly alike as to be considered varieties, attain 100 feet height by three diameter, are straight, and produce strong and durable timber superior to the European larch or any American pine. They are esteemed admirable timber in Canada, and used in Maine for ship knees. They are very similar in habits and appearance to the European larch.

HÆMATITE. Iron ore.

HÆMATOSIN (from *αιμα, blood*). The red colouring matter of blood.

HÆMATOXYLIN (from *αιμα*, and *ξυλον, wood*). The red dye extracted from logwood.

HÆMORRHAGE (from *αιμα*, and *ῥαγη, rent*). A flow of blood, either from an accident or from a full state of body. In the case of wounds, if severe, it may proceed from a torn artery that should be tied with a ligature. Constitutional hæmorrhages require blood-letting and a low diet.

HÆMORRHOIDS. Piles. Astringent ointments are useful in common cases.

HAIL. Atmospheric water congealed into lumps of some size, often measuring an inch across. It is altogether different from snow, in occurring during the spring and summer. Hail is produced only during violent winds, which carry a great deal of moisture into the upper regions of the air, where it becomes solidified by extreme cold. In Europe losses from hail can be met by insurance in companies founded in the same way as those against fire.

HAINHAULT SCYTHE. See *Scythe.*

HAIR. Slender tubes of animal matter analogous to horn. It is an admirable non-conductor of heat.

Refuse hair ranks as a manure with skin or glue, producing the same results by decay: *woollen rags* are the most familiar kind used in this way.

HAIRS. In botany, transparent tubes of cellulose inserted into the epidermis; they are totally dissimilar from animal hairs, in containing no nitrogen. *Cotton* is an instance of hairs attached to seeds.

HAIR GRASS. The genus *Aria.*

HALCYONIDÆ. A family of fissirostral birds, of which the kingfisher is the type.

HALESIA. The snow-drop tree (*H. tetraptera*); ornamental trees of South Carolina, introduced into the shrubberies of the Middle States.

HALHYDRATES. Salts in which

the combined water of the acid becomes a component of the salt.

HALOGEN (from ἅλς, *a salt*). Bodies which unite directly with metals, without any previous oxidation, and form salts, as chlorine, sulphur, fluorine: their compounds are termed *Haloid* salts.

HALTICA. A genus of small coleopterous insects, remarkable for their readiness in leaping. The turnip flea is a familiar species.

HAM. The thick part of the leg. See *Hog*.

HAMES. The wooden or iron collar pieces to which the traces are attached.

HAMMER BEAM. A horizontal timber from or near, but above the foot of a rafter, acting as a tie.

HAMSTER. *Mus cricetus*. A kind of rat found in the north of Europe, which makes extensive stores of food.

HAND. A measure of four inches, used in estimating the height of horses. The fore leg of a horse or other animal.

HARD WATER. Water containing salts of lime, especially gypsum. It is softened by adding a little soda-ash or ammonia.

HARICOTS. See *Beans*.

HARE. The genus *Lepus*, herbivorous rodents, often a great annoyance to farmers. They are readily taken in traps.

HARL. The refuse skin of flax and hemp.

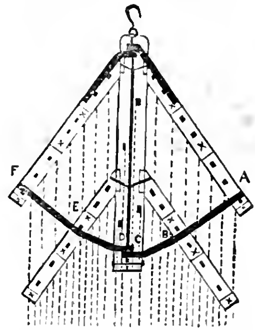
HARNESS. The gearing of horses. It should fit well, or galls are produced. The harnessing of steers has been recommended to obtain more effective labour.

HARRIERS. A breed of dogs used for hunting hares.

HARPALUS. A genus of *predaceous coleopterans*.

HARROW. The common form of this implement is a triangle or rhomboid, set with straight iron spikes four or more inches long; these tear the surface recently ploughed, pulverizing the lumps, and covering seed slightly. The frame is of ash or oak, but sometimes of iron. Other harrows, with curved teeth, for tearing out and carrying along weeds, are also used, called extirpators, or scarifiers. See *Cultivator*. The expanding harrow, in which the distance of the bolts of the frame can be set according to circumstances, is a convenient instrument.

The following, from Mr. Geddes, is thought an excellent instrument. The



sketch is on a scale of one fourth of an inch to the foot:

"*Description.*—Timber, three inches square.

"The side pieces should enter the centre pieces so that the acute angle will contain thirty-five degrees; or the bevel may be found by laying a carpenter's square on a board, and measuring on one side of the corner three inches, and on the other two inches and one twelfth of an inch; a line drawn through these points will make a triangle, having the smaller angle, that is, the angle at the point where the three inches reached—the angle required.

"The tenons should enter the centre pieces only one inch, the mortice and tenon being cut square with the centre pieces, as shown in the engraving. If this joint is well made, the bolt passing through both sticks will keep the timber in place perfectly, the side pieces have each three bolts, X, X, X, passing through the middle, to prevent their splitting. The back hinge is made of Swede's iron, bolted, at A, B, C, D, E, F, on the timber with half inch bolts. These bolts should be well made, and have large heads on the lower end, as if anything breaks, it probably will be these bolts

"The forward hinge is made with Swede's iron, and bolted on the top of the timber, with three bolts in each side of the hinge.

"The hook plays freely in an eye on the end of a rod, made of round iron, five eighths of an inch in diameter, which runs through both hinges, having a washer, nut, and spring key behind the back hinge. The eyes in the hinges should be the thickness of the iron above the timber, consequently the rod running through the eyes will be that much above the timber.

"The hinges should be four and a half feet apart from centre to centre.

"The centre pieces should be one inch apart.

"The side pieces should be twelve or thirteen inches apart in the clear, measuring square across.

"The four teeth in the centre pieces require to be made straight on one side, instead of having the point in the centre, as their places are near the sides of the timber.

"The teeth should be seven eighths of an inch square, and thirty to the harrow."

The common bush harrow, consisting of a bundle of bushes fastened to an iron chain, or woven into an old gate or wooden frame, is much used for rubbing seeds into the soil. When the shrubs are thorny, it answers to scarify natural meadows after manure is applied. The *Fig.* on p. 120 represents a simple bush harrow.

HARTSHORN SPIRIT. Solution of ammonia. See *Nitrogen.*

HARVEST. "In those southern climates where the heat and want of moisture are not too great for the growth of corn, the only care of the farmer is to procure hands sufficient to reap it. The heat of the sun and air soon dry the straw and harden the grain. A spot is levelled in the field, and the corn is thrashed out immediately, either by the tread of cattle driven over it, or by the flails of numerous thrashers. The corn is winnowed and stored in granaries, and the straw is reserved till winter, when it forms the chief fodder of horses and cattle. In these regions the harvest is a continued feast; no ungenial weather disappoints the hopes of the husbandman; but in northern climates, where the harvest is later, and cold rains and storms are frequent in autumn, the ingenuity is often taxed to save the corn from being entirely spoiled, after it has been severed from the ground; roomy barns are erected to secure it in the straw till it can be thrashed.

"To lessen the casualties of harvest, the experienced husbandman endeavours to arrange the time of sowing each kind of grain so as to ensure its coming to maturity in a regular succession. Thus he has more time to attend to the precautions of which experience has taught him the utility; and if the duration of harvest is longer, there is less danger of all his crops being spoiled by a wet season.

"It was long the custom through the whole of the north of Europe to store all the produce of the farm into barns, especially the corn; and it was thought that as soon as the sheaves were collected under a roof all danger was past. The increase of the produce raised on most lands by an improved system of agriculture gave rise to the practice of stacking corn in the open air, and securing it by a covering of thatch. It was soon found that the grain thus stored in the straw was better preserved than that which was in the barn; and the invention of stone or cast-iron pillars as supports for the frames on which the grain was stacked, not only secured it from the depredations of vermin, but kept it in a much drier state than when the stacks were made on the ground. This was a great improvement; and now, in the best-managed farms, the only barns required are those in which the corn is thrashed; and if there is sufficient room to hold the contents of one stack of the usual dimensions, it is all that is absolutely required.

"It may be admitted as a general rule in reaping, to cut the straw as near to the ground as possible: this is best done by an instrument called a *cradle scythe*, which mows the straw, and collects it so as to be readily gathered into sheaves.

"The Hainault scythe has a very short handle, and is used with one hand, while the other collects the straw into a sheaf by means of a large hook at the end of a wooden rod. It is a most useful instrument, and greatly preferable to the fagging-hook; it cuts more straw at each stroke, and is less fatiguing to the reaper, because his position is nearly upright when he uses it. In many places it is not usual to tie up any corn into sheaves, except rye, wheat, and beans. Barley and oats are usually mown, raked into heaps, and carried into the stack or barn when dry, like hay; but this is a slovenly practice, which should not be recommended. With good tillage and proper manuring the straw of barley and oats will be strong, and of sufficient length to require being tied up into sheaves; and much less of the grain is shaken out and lost in this way than by the usual method.

"In rainy seasons it frequently happens that the sheaves remain a long time in the field before they are sufficiently dry to be carried and stacked. If the ears are not secured from the wet, they become soaked, and the grain sprouts in the ear. This is a great loss; for sprouted grain is very inferior, and can only be sold at a low price. A little attention will often prevent the bad effect of rains. In some places six or eight sheaves are set up in a circle, with the butt-ends diverging, so as to admit the air to circulate among them; a sheaf is opened by spreading out the ears, and is placed, inverted, over the ears which lean against each other, forming a truncated cone. Thus the butt-end of the top sheaf is the only part in which the rain can lodge; and the first sunshine will soon dry this: the rain runs off the sides of the inverted sheaf, and the ears, pointing downward, will not long retain the wet.

"When the stack is building, the butts of the sheaves are placed outward, and project gradually over the sides of the frame, and over one another, so as to build the stack in the form of a bowl, with a cone or pyramid over it, according as the frame is round or square; this is carefully thatched with straw, and the outer surface is cut smooth by means of shears. This not only saves all the ears which chance to lie outward, and which would have become the prey of birds, but it also prevents the rain from beating into the stack and injuring the corn. It may then be considered as safe.

"Where there are no raised frames, and the stack is built on the ground, or on a bottom made of fagots to keep it dry, a belt of plastering or stucco is sometimes laid, a foot wide, round the stack, about 18 inches from the ground, after the surface has been cut quite smooth and even. This contrivance is intended to prevent the rats from lodging in the stack, and it is very effective. A frame made entirely of iron, and supported upon iron columns, has lately been invented. It may readily be taken to pieces and put together again when it is wanted. The advantage of it is, that it is cheaper and more easily moved than any other, and it is very convenient for a temporary purpose."—(*W. L. Rham.*)

HASTATE. A descriptive term in botany: shaped like the old halbert.

HATCHEL. A carding-comb or hackle.

HAUGH. Meadow or pasture land.

HAUSTELLATES. Insects furnished with a proboscis for suction.

HAWK. The genus *Falco.* They prey upon birds. Martens and crows are remarkable enemies to the hawk species.

HAULM. The stalks of pease and beans, chiefly.

HAWTHORN. *Mespilus oxyacantha.* This thorny shrub or small tree is also called whitethorn, May, and quickset. It is abundantly used in

England as a hedge plant; with proper trimming it forms a dense growth, and its thorns protect the plant from destruction by cattle. The seeds of the previous year are kept in wet sand during the winter, and sown in spring in drills in a light soil to procure plants. The seedlings may be set out in two years, and by a little care will form a hedge in three to five more. Many native thorns would answer equally well.

HAY. Grass or clovers cut and cured for cattle. Well-cured meadow hay, seasoned with one peck of salt to the load, is the standard of fodder for cattle and horses; about 30 lbs. daily is allowed as suitable food for a horse or ox in work. Boussingault found that the average amount of flesh-making food in good meadow hay was 7 per cent., but that aftermath sometimes contained as much as 12, and hay from wet places as little as 6 per cent. There is a prejudice against after-math, probably arising from its being cured in an inferior manner to grass of the first crop. Mow-burned hay is peculiarly injurious to horses.

It is the result of the experience of many French farmers that grass and clover are much more nutritious when given in the green state than when dry, if the same amount of food be contained in both parcels, or omitting the water. The conversion of these and other herbs into hay is attended with a fermentation which reduces the amount of *flesh substance* they contain.

Horses require as much water as hay when fed on it only; but the practice is beginning to be extended of steeping the hay in water for an hour before feeding, by which animals are induced to feed much cleaner. *Hay tea* is made by introducing the hay into hot or boiling water, but this does not seem to be better than merely saturating it with fluid by steeping, and giving the water, as well as the hay, to the animals.

Large quantities of hay are shipped from the Northern and Northwestern States for the South; it is pressed by screws into trusses, and bound with cords and slips of wood.

HAY-MAKING. The first point is the proper season to cut the grass or clover; this would seem, in the case of some grasses, to be a doubtful question, as the quantity is very much increased when the crop is in seed; but usually the rule is to cut when in full flower; by this means more and better hay is obtained, and the soil is less exhausted.

There are two ways of making hay: 1st. By laying the swath to dry thoroughly, turning it during the day, or even tedding or spreading it abroad thinly. This is, towards evening, collected in small cocks; these are spread out the next day into windrows and turned, again put up into larger cocks towards night, and exposed the third day before being taken to the mow or stack. By this means the grass is thoroughly dried, but the plan is very tedious and unsuccessful where succulent plants like clover are to be made into hay.

The second and approved plan is to allow the swath to be turned and withered, piling the grass, &c., in small cocks of 200 lbs. by midday, if cut before breakfast; in this situation a sweating process or fermentation occurs, attended by heat and an exudation of moisture, which tends to cure the hay rapidly. The next morning, the cocks should be examined, and if the heat is abated the grass may be tedded for a short time, and carried to the stack or barn by noon. It is here to be stacked with from one to three pecks of salt to the ton, will heat again slightly, but, if not too green, cures beautifully, affording very fine hay. Some farmers prefer putting it in stack with strata of good straw, especially in the case of clover; heat is thus avoided and the straw enriched as food; it also saves some of the salt.

By this process, broad-cast corn and other green, succulent stems can be cured, if sufficient time be given them to sweat.

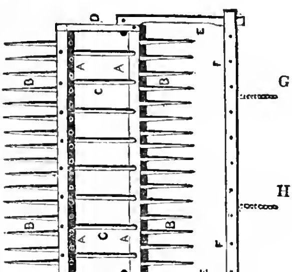
Hay is often put up into temporary stacks, and removed after a few days, or at a convenient season, into larger masses: in England the stack often contains forty or more tons; it is carefully thatched, and portions cut out by a knife for use. The cubic yard of stacked hay weighs 160 to 180 lbs., and, when old, 200 lbs.

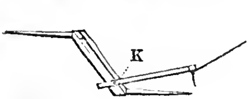
After-math is usually depastured, the manure dropped answering to advance the next crop if properly scattered. In some parts of France and Germany the green grass is thrown into pits with one bushel of salt to the load, and allowed to ferment; it is afterward closed in with boards, and earth placed upon them; thus a kind of *sour kraut* hay is formed, which, it is said, cattle prefer.

HAY-MAKING MACHINES. An instrument to scatter, or ted, is much used in Europe: it consists of a frame of many spokes supported on an axle with two wheels; the frames carry curved teeth like rakes, and revolve with the wheels; the rakes carry forward the hay and scatter it thoroughly. It is drawn by a horse.

The Horse Rake is a large rake made of wood, and six to ten feet long, before which a horse is hitched; it is furnished with a couple of handles behind to enable a man to lift it up when necessary.

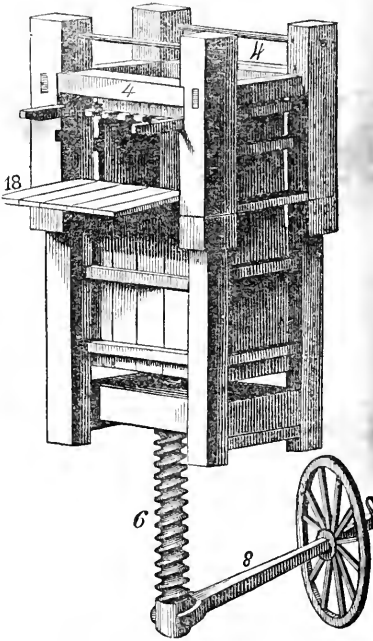
Revolving Hay Rakes are made on various plans, of which the following appears the simplest.





This rake consists of two heads, A, A, and two sets of teeth, B, B; the heads being connected together by connecting rods, C, C, and end bars, D, D. The end bars also form a groove in which the slide pin (K, in the end view) moves from one head to the other every time the rake revolves. The horse is attached to the rake by hooking the trace chains, G, H, into staples driven into the under side of the cross-bar, F, F. The rake is held by the teeth, which serve for handles when they are up, and for teeth when on the ground.

HAY PRESS. The following is a convenient form; it is sometimes called Lampman's press.



It consists of four upright posts strongly framed together, within which is a chamber of stout plank of the size of the intended bundle of hay. The press is firmly fixed between the lofts of a barn, the hay being thrown in above, and the horse power applied to the sweep (8) and screw (6) below. The sides of the chamber are opened to remove the pressed hay by doors hung upon rollers (18), and the upward pressure of the screw is resisted by a strong cap (4), which is pushed backward or forward at pleasure.

HAY KNIFE. It consists of a stout blade furnished with a handle at right angles, or, in another form, of a blade somewhat like a spade, the handle being above, and the cut made by pressing downward.

HAY STACK, or RICK. See *Stack*.

HAY TEA. The infusion made by pouring boiling water over hay; it is said to replenish the udders of cows, cause horses to stale freely, and to be very nutritious.

HAZEL. See *Filbert*.

HEADING TREES. The operation of cutting down the stem or main shoot, to diminish the height and cause the tree to throw out horizontal or bearing limbs.

HEAD LANDS. The places where the plough turns in ploughing.

HEART. The central hollow muscle which receives the blood and drives it over the system.

HEART WOOD. The central, old, and coloured wood of trees: it is the most durable. The duramen.

HEAT. See *Caloric*.

HEATH. Waste lands covered with heath plants, species of *Erica*.

HEAVY SPAR. Sulphate of barytes; it has a specific gravity of 4·1 to 4·6, and is used to adulterate white-lead.

HECKLE. An instrument for separating the fibres of flax. See *Flax*.

HECTIC FEVER. A fever occurring in debilitated persons.

HEDGE. A row of small trees or shrubs, properly pruned, and serving as a fence between fields. The hawthorn, Virginia thorn, holly, buckthorn, Osage orange, red cedar, arbour vitæ, form good hedges, especially the first four; the honey locust, privet, pyrus japonica, elder, and other plants are also occasionally used. The young plants, at two to three years old, are to be removed from the nursery to the hedgerow, either in the fall or early spring, the tops being pruned away. The line of hedge should be first well ploughed and prepared; it will be of service to enrich it with well-rotted peat, mould, or manure; it may be two feet wide, and if the soil is not very well drained, a ditch, one foot deep, may be dug on each side, and the earth cast up on the middle. The plants are to be weeded, and pruned in the fall to one third their height, and afterward managed by foreshortening until of sufficient height and bushy; they may be placed in quincunx order, and somewhat inclined across the ground of the hedge. While young, the plants are to be protected from cattle by fencing. Old hedges which have become too tall, or show little verdure, may be re-established by cutting a part of the main stems to the soil, and allowing the stools to throw up new shoots. In this kind of trimming, the stems are to be cut upward with the bill, and not downward, for, in the latter case, the stem is often split; water lodges and rots it, in some measure.

Worn-out hedges do not succeed if replanted with the same trees; a new line must be chosen or new trees used. In repairing gaps, it is often necessary in an old hedge to plant dissimilar shrubs, or to cut out the soil with a spade and introduce some that is new.

There is a method of repairing hedges which is called *plashing*. It consists in cutting half through some of the stems near the ground, and then bending the upper parts down in a horizontal or oblique position, keeping them so by means of hooked sticks driven into the bank. Thus a live hedge is made, which fills up the gaps in the same manner as a dead hedge would have done, and the bent stems soon throw out shoots. If the stems are young, and not above the thickness of a finger, an excellent hedge may be thus formed, which, when clipped, will be close and perfectly impervious; but the work is generally done in a very injudicious manner. When a hedge is plashed which has been long neglected, the thick stems which are hacked through, leaving only a small portion of the under bark uncut, have an unsightly appearance, and seldom throw out shoots near the bottom, where they are most wanted. To plash a young hedge, by merely bending the twigs, is an excellent practice; but when the stems are thick and old, the only remedy is to cut them down, or make an entirely new bank well planted with quick.

Hedges are highly ornamental and durable, lasting, with care, for fifty or more years; they require clipping in spring, and, when well established, are a perfect protection; they are particularly worthy of attention to the prairie farmers. Fruit-trees, especially cherries, grapes, and plums, may be made use of as mere partitions between fields, when trained on espaliers. Hedges are also variously curved and bent over, or breasted for ornamental purposes.

Instruments used in hedging.—A small hoe is necessary for weeding, a hooked knife to trim short branches; sometimes large shears are used, and a bill or small axe to cut the larger branches.

HEDGEHOG. The name of a genus of useful insectivorous mammals (*Erinaceus*), of service to the farmer by destroying worms, slugs, and insects. They hibernate during cold weather in holes dug in the earth.

HELIOTROPE. A pretty flower. A silicious mineral of a green colour with red spots; bloodstone.

HELIX (from ἑλιξ, *a whorl*). A genus of shell animals, including the garden snails; they are injurious to herbage, and may be kept off by sprinkling with lime, or destroyed by catching with the hand.

HELLEBORE. A genus of plants remarkable for their purgative properties. *Helleborus fœtidus* is a native of the United States; they are very dangerous and uncertain drugs.

HELMINTHOLOGY (from ἑλμινς, *a worm*, and λογος, *a discourse*). The history of worms of various kinds.

HELOPIDÆ. A family of heteromeran, coleopterous insects. Some of the species infest the bark and roots of trees.

HELVE. A handle.

HEMATIN. Synonyme of *Hæmatoxylin.*

HEMATITE. Synonyme of *Hæmatite.*

HEMATOSIN. Synonyme of *Hæmatosin.*

HEMELYTRA (from ἡμισυς, *half*, and ελυτρον, *a sheath*). The wings of hemipterous insects: the upper wing-cases, half of which only is coriaceous, the rest being delicate.

HEMEROBIANS (from ἡμερα, *a day*, and βιος, *life*). Short-lived insects of the neuropterous class, resembling the May fly; they lay their eggs on plants, and the larvæ devour plant-lice, and thus subserve the purposes of the orchardist.

HEMIGAMOUS. A descriptive term in essays on grasses, meaning that one of two florets in a spikelet is neuter.

HEMIPTERA (from ἡμισυς, and πτερον, *a wing*). Insects having four wings, the upper pair of which is only half coriaceous, or which are half horny and half membranous; they are haustellate. The larvæ have six feet, and resemble the imago; after a few moultings they increase in size and acquire wings.

HEMLOCK. *Conium maculatum.* An umbelliferous plant, with perennial roots, flowering in July; branches much spread and dotted; leaves very compound. It is narcotic, and often injures cattle.

HEMLOCK-TREE. *Abies Canadensis.* It grows abundantly in the northern portions of the United States and the British Provinces. It is a good timber-tree, and often attains very great dimensions.

HEMP (*Cannabis sativa, Fig.*). A diœceous annual of the family *Urticaceæ*, cultivated for the large amount of fibre it produces in the year; the seeds are also serviceable as fattening food, when given in small quanti-

ty, and yield, by expression, from 25 to 30 per cent. oil. The leaves of the plant are poisonous, and a steep made with them is of great use in the garden to annoy insects.

Cultivation.—Hemp requires a rich, deep soil, abounding in vegetable matter, a grass ley is admirable; it is to be well ploughed and made fine; the seed, to the amount of 1½ to 2 bushels, is commonly sown broad-cast in April and May, when the frosts have disappeared. The seed is either harrowed or ploughed in shallow. The hemp is ready for cutting from the middle of August, as soon as the leaves of the male plants turn yellow and drop off. It is cut with a harp hook or short scythe. Half an acre can be cut and an acre scythed in the day by a good hand when it is not overgrown. The cut stalks are evenly laid on the ground, and require a week of good weather to dry: a shower is no disadvantage. Some persons pull the hemp, but this is slower work, and produces less perfect lint, while the roots are a great inconvenience.

The dried plants are next to be tied into sheaves, and put up into a rick to preserve them from the effects of moisture during hot weather. The roof must be closely made of long hemp, the leaves of which are beaten off. Some beat all the leaves off, but this is unnecessary labour, for if the plants are well dried, they will be knocked off in handling. The best time to spread the hemp for *dew* rotting is December, but where the crop is large, a commencement is made in the middle of October. The hemp stems may be kept without injury in stacks for one or two years. Judge Beatty urges that the proper rotting ground is the hemp field, for the labour of hauling is much diminished; the plants manure the land, and it is kept free from the treading of cattle. The *winter-rotted* is lighter and better than that of autumn; the hemp is sufficiently rotted when the stems lose their rigid appearance, the bundles of fibres begin to be disengaged from the cellular tissue, and the lint begins to separate from the stalk. When ready to be taken up, it should be put in upright shocks of 150 pounds; as soon as it is dried the tops may be bound with a hemp band sufficiently tight to keep out rain. It is now to be broken, frosty weather being best; this should be completed before the warm weather of spring: 100 pounds per day is fair work with the common brake. Good lands yield from 750 to 1000 pounds of lint the acre; and if it be rotted on them, and no seed taken, seven or ten crops may be taken after one another. For the production of seed, the hemp is sown in drills or hills; if the latter, they are placed four feet apart; a dozen seeds are dropped in each hill, and covered an inch. The soil must be very rich, and well prepared; the ground is to be kept free of weeds at first by the plough, and subsequently by hoeing; the plants are next to be thinned to four or five when six inches high, and again to three in a hill. As soon as the plants are in full blossom and the farina spread, the *males* or flowering plants are to be cut from each hill. The seed will be ripe in September, when the plants are to be cut early in the morning, and without much jarring, or the seed will be scattered. The plants are taken from the ground when dry and set up in shocks, the butts towards the earth.

It should not be allowed to become too wet, but a little moisture assists the closing of the seed. In a week or ten days it may be thrashed, by beating the upper parts of the plant upon a board; the seeds separate readily, and may be thrashed on the field, for carriage leads to much loss. The stems are of no use for lint, but may be used for charcoal, or burned to ashes as manure. Hemp seed very readily spoils, unless well dried before stored; it is also much sought after by rats. It is seldom so well kept as to be worth sowing after the first season. The crop of seed is from 20 to 40 bushels, which sells at upward of $1 the bushel. The lint is worth from $90 to $180 the ton.

Water-rotting hemp is not much practised, from prejudice and from the little demand for it near the country markets, but the offer of the government to pay $280 the ton has induced many to attempt it. The best place is in running streams, a sufficient space or pit being set off for the operation; it may be planked or bricked, or a frame like that for flax may be used. The dry bundles of hemp are used. The following is Professor Lowe's account of water-rotting:

"The bunches are generally placed in the pool in rows, crossing one another, and pressed down by some heavy substance laid upon them, so as to be kept from rising to the surface, care being, at the same time, taken that they are not so loaded as to be forced down to the bottom. If the weather be warm, four or five days will frequently be sufficient; if not, two or three more; but the period is denoted by the stem being so softened that the outside coat shall come easily off. Care must be taken, as in the case of flax, that the putrefactive process does not proceed so far as to injure the cortical fibres. The quantity put into one pool may be the produce of an acre. The steep liquor is poisonous; hot-water rotting, with the use of soap, as in the preparation of flax, is partially used in Europe, and is a great saving in time.

"When the hemp is thus steeped, it is, like flax, taken out of the pool and carried away to a plot of sward, on which the plants are spread singly and regularly.

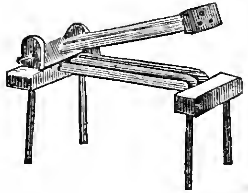
"The hemp thus spread out lies three, four, or more weeks upon the surface, and is turned over not less than twice a week. It is thus subjected to the farther influence of the rains and dews, and the decomposition of the ligneous part of the stem is promoted. By this process, the stem becomes hard and brittle.

"When the hemp is seen to be in a state for removal, it is taken from the ground, bound into bunches, and carried home to the barn, where it undergoes the process of bruising by the machine called a brake, as in the case of flax.

"When thus prepared, it is bound up in bunches, generally weighing a stone each, and carried to market. The hemp which breaks off in the operation is technically termed shorts, and is half the value of the long hemp."

It should be remarked that, with proper care in bleaching, rotting, and raising hemp, a fibre may be obtained capable of being wrought into excellent linens. The preparation of the stems by steam is said to give the fibre great delicacy and whiteness; the waste is also said to make good paper. Hemp is nearly free from diseases.

The *instruments* used to prepare the staple are similar to those for flax, but larger; the brake (*Fig.*) is



considerably larger, being six or more feet long; it is made of white oak. The hemp is sold after breaking, the sutching, hackling, &c., being done by the manufacturer.

HEMP SEED. It forms an admirable food for birds and poultry in small quantity, and may also be used in fattening animals, when sufficiently cheap. The oil is used for soap-making and painting, in varnishes and printers' ink. It is expressed in the ordinary way; the refuse or cake is as good as oil cake for cattle or manure. A bushel of seed yields 6 to 8 lbs. of oil, and 23 of cake. Very rich seeds afford 25 per cent. oil.

HEMP, SUBSTITUTES FOR. Numerous plants yield a strong and abundant fibre besides hemp, and have been recommended for cultivation in its place. The principal of these are the Chinese nettle (*Urtica nivea*); hemp, or Siberian nettle (*U. cannabina*); golden rod, several varieties of broom plants, sunflowers, okra, aloes, and especially the *Yucca filamentosa*, which grows abundantly on poor soils in the Carolinas and South. The Sisal hemp is from a Mexican agave; the *A. Americana* also furnishes much fibre when the leaves are prepared; but, with the exception of some of the nettle plants, none approach the hemp in the amount of lint they produce.

The genus *Apocynum* yields some good hemp plants, of which *A. cannabinum*, or Indian hemp, is best known. It has a perennial root, and throws up shoots two to four feet tall annually.

HEMP, CHEMICAL COMPOSITION OF ITS ASHES. The stem, dried at 212° Fahrenheit, yields 4·54 per cent. ash, the leaves 22 per cent. Composition:

	The plant (Kane).	Seeds (Leuchtweiss).
Potash and soda	7·20	22·33
Lime and magnesia	46·93	27·63
Phosphoric acid	3·22	34·72
Sulphuric acid	1·10	0·18
Chlorine, alumina, sand, and iron	40·55	15·14
	100·	100·

From this we gather that hemp is a lime plant, and will be much benefited by that manure, and also see why the seed crops are so exhausting, as they draw a large proportion of bone earth from the soil.

HENBANE. *Hyoscyamus niger.* This narcotic herb grows to a small extent in Northern New-York. It is biennial, and the leaves are active in the second year of its growth. It is an excellent medicine, and no danger may be apprehended from animals touching it, as they always avoid the plant. If swallowed by children, an emetic should be instantly given.

HENTING FURROW. Two furrows lying in different directions.

HEPATIC (from ἧπαρ, *the liver*). Relating to the liver.

HEPATICÆ. A family of flowerless plants, resembling mosses, and growing in damp places.

HEPTANDRIA, HEPTANDROUS. Flowers with seven stamens.

HERBACEOUS. Of the succulent texture of an annual plant.

HERBAL. An account of plants; a collection of plants.

HERBARIUM. A collection of dried plants.

HERBIVOROUS. Eating herbs.

HERD. A number of beasts.

HERD'S GRASS. *Agrostis stricta.* The red-top of the North, an indigenous perennial grass in wet places. See *Grasses.*

HERMAPHRODITE. An animal or plant in which there is a real or apparent concurrence of the generative organs of both sexes. It is most common in plants, and is also found among some of the lower invertebrate animals. In the higher orders it is unnatural.

HERMETICALLY SEALED. When the glass of a vessel is fused so as to be perfectly closed on all sides. Entirely shut up.

HERNIA. A rupture or protrusion of any part of the body, especially of the intestines. It is to be returned to its place, and kept there by bandages and trusses. Hernias often prove fatal. When the intestine cannot be returned by the hand, recourse is to be had to an operation, which, however, requires considerable skill.

HERPETOLOGY (from ἑρπετος, *a reptile*). The natural history of reptiles.

HERRING. A migratory fish, of the genus *Clupea*, resembling shad in flavour, but much less in size.

HESPERIDIUM. In botany, a many-celled, few-seeded, superior, indehiscent fruit, covered by a spongy, separable rind; the cells easily separable from each other, and containing a mass of pulp, in which the seeds are imbedded: example, the orange.

HESSIAN CRUCIBLE. A melting-pot made of fine clay and sand; the small sizes are much used in the laboratory to fuse metals, &c.

HESSIAN FLY. See *Wheat Insects*.

HETEROCEPHALOUS (from ἑτερος, *various*, and κεφαλη, *a head*). In composite flowers, when some heads contain male, and others female flowers.

HETEROGAMOUS (from ἑτερος, and γαμος, *marriage*). When the spikelets of the same grass contain dissimilar sexes, or when the flower heads of compositæ contain florets with different sexes.

HETEROGYNIA (from ἑτερος, and γυνη, *a female*). A tribe of hymenopterous insects, as the bee and ant, in which one female is neuter and another fertile.

HETEROMERANS (from ἑτερος, and μηρος, *a leg*). A class of coleopterous insects, having the first and second pairs of legs with five joints in the tarsus, and the third pair with only four.

HETEROPTERANS (from ἑτερος, and πτερον, *a wing*). A tribe of hemipterous insects, in which the upper wing cases terminate abruptly by a membrane.

HETEROTROPAL (from ἑτερος, and τρεπω, *I turn*). When the embryo of a seed lies across it, but does not point towards its base or apex.

HEXAGYNIA. With six pistils.

HEXANDRIA. With six stamens.

HEXAPODS (from ἑξ, *six*, and πους, *a foot*). A tribe of wingless insects with six feet.

HIBISCUS. A genus of mucilaginous plants of the *Malvaceous* family.

HICKORY. *Carya*. An American genus of trees resembling the walnut. They all produce a hard, compact, but coarse-grained wood, of great strength. The shag-bark (*C. alba*) and the Southern pecan-nut (*C. angustifolia*) produce the best fruit. The hickories do not flourish far North, but require a temperate climate and good soil; most of them require a moist soil, especially the shell-bark and pecan-nut; the common hard-bark (*C. tomentosa*) is, however, partial to a drained soil. The pig-nut hickory (*C. porcina*) is the largest variety, often rising to 90 feet, and produces wood equal, if not superior, to the other species.

Hickory wood is very liable to insects, and decays soon when exposed to changes of moisture and heat. It is much used for axletrees of carriages, wooden screws, cogs, handles of various kinds, especially handspikes. The young trees form the best hoops for casks.

The wood forms the best fuel of our forests, from its density.

HIDE. The strong skin of horses, oxen, &c. Green hides just removed from slaughtered animals are altogether superior for the tanner. Drying by exposure to the sun, and rubbing with ashes, or salting, make it more difficult to thoroughly tan afterward.

HIDEBOUND. A condition of the skin of animals when it seems to adhere to their bones. It is usually the result of want of care, or a symptom of disease. Slight purging and alteration of food, with better care, will alter this state.

HIDE, or HIDE OF LAND. An ancient measure of from 100 to 150 acres.

HILUM. The scar on a seed, where the funicle is attached, or where it is united with the carpel.

HIPPOBOSCA. A genus of viviparous, two-winged insects, which prey on horses and other animals; the *forest* flies are of this race.

HIPPURIC ACID (from ἱππος, *a horse*, and ουρον, *urine*). An acid existing in combination with soda, in the urine of horses, cows, and persons eating certain vegetables. It is separated by muriatic acid, and, when pure, is crystallized in silky needles. It is slightly bitter, soluble in hot water and alcohol. The formula is $NC_{18} H_8 O_5 + Aq.$ for the crystals. It is converted by heat into benzoic acid, ammonia, and prussic acid. Any quantity of this acid can be formed by taking doses of benzoic acid, which becomes transformed into hippuric. Its compounds with bases are called *hippurates.*

HIRCIN. The fluid fat separable from suet, which gives it the peculiar odour resembling the smell of goats. By saponifying, hircic acid may be obtained.

HIRSUTE. Set with stiff hairs.

HIRUDINÆ. The tribe of leeches.

HIRUNDO. The genus of swallows.

HISPID. Set with minute spines, or stiff bristles.

HISTER, HISTERIDÆ. A family of coleopterous insects with five joints on each tarsus, and belonging to the section of *Clavicornes.* They are peculiar from the quickness with which they feign death when in danger.

HIVES. See *Beehives.*

HOARFROST. Frost attended with the precipitation of much watery vapour.

HOARY. In descriptive botany, covered with short hairs, so as to have a white or frosted appearance.

HOE, HAND. The practice of hoeing, though laborious, is eminently useful in pulverizing the soil, admitting air, warmth, and dew. Soils, well broken and rendered fine, are very much more fertile than when allowed to bake and become hard. Land should be hoed when hard and partially dry, especially about young plants. The figure of the hoe is altered to suit different tillage. The common hoe and grubbing hoe are familiarly known. *Fig.* 1 represents the head of the Spanish hoe for weeding. *Fig.* 2 is the thrust hoe, for the same purpose. *Fig.* 3 is a useful compound hoe, the fork of which may be used first on stiff lands, and the blade afterward. Some hoes, for weeding small plants, are made with the blade cut into two or more teeth: they enable the gardener to scrape the earth about young plants very effectively.

Fig. 1.

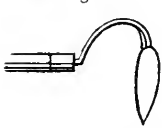


Fig. 2.

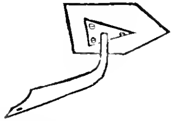
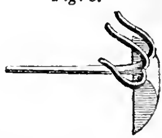
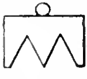


Fig. 3.



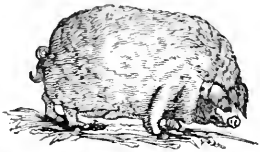


HOG. "The hog is one of the domestic animals which is most widely dispersed through the world, and yields to no other in its usefulness. It lives and thrives on every kind of food, vegetable or animal. It grazes like the ox, and will even eat hay; and its stomach can digest what few other animals could swallow with impunity. The sow bears two litters in the year, having from eight to twelve, and even sometimes eighteen or twenty young at a time. No animal converts a given quantity of corn or other nutritive food so soon into fat, or can be made fat on so great a variety of food.

"The food of the hog in a wild state is grass, roots, acorns, beach-mast, and wild fruits.

"There are many varieties of the domestic hog. The brindle hog most nearly resembles the wild species; but although the flesh is savoury, he does not fatten so soon, nor is he so profitable as the more indolent and softer-skinned sorts are. The great quality of a hog is his power of digestion: the more rapidly he fattens, and the earlier he can be made to increase in flesh without increasing in bone, the better is the breed. Some of the small hogs which are brought from China are remarkable for this quality, as well as for their prolific nature; and when, by judicious crossing, the size is increased, they are a very profitable breed. The Chinese pig (*Fig.* 1) is short in the head, with

Fig. 1.



small ears, very wide in the cheek, high in the chine, and short in the leg. When a sow of this breed is heavy in pig, her belly generally drags on the ground. The young pigs of the Chinese breed, especially the white variety, are excellent for roasters, at three weeks or a month old. They are small and fat, with little bone, and their skin is very delicate. They also make excellent porkers at about three months old, when kept for some time after weaning on the refuse of the dairy. They may be kept fat from the time they are weaned till they are fit to be killed for bacon; and although they do not come to a great size, they will pay very well for their food if killed at a twelvemonth old.

" The breed that is nearest to the Chinese is the Suffolk. They are generally white, with the ears pointed and rather forward: they are broad in the chest and loins, short and compact: they make fine bacon hogs at twelve or fifteen months old, weighing from twelve to fifteen score when killed. The sucking pigs and porkers are also very delicate. The Essex breed is mostly black and white; the pure breed, however, is said to be quite black, and is so nearly allied to the smooth Neapolitan breed, which has scarcely any hair, that we cannot help supposing a consanguinity between them. When crossed with the Neapolitan, they produce a breed which fattens at a very early age, and to an astonishing degree. A breed of this cross, carefully selected by Lord Harborough, has gained the first prizes for fat pigs at the Smithfield annual Christmas shows for several years past. They were fed extravagantly, no doubt, but at twenty-two weeks old they were so completely covered with fat that their feet were scarcely to be seen; and if they could stand, which is doubtful, it is certain that they could not walk."

Mr. Coleman speaks favourably of a grass breed raised in New-York: " This is a hog, raised with little other feed than clover pasturage for the first six months, of a white colour, with black patches sprinkled over him, long and well formed, of good thrift, and who, with good keeping, at eighteen months old is easily brought to 400 and 500 pounds weight."

" The Neapolitan hog is black, without any hair, very plump, with pricked ears. No breed can excel it in the aptitude to fatten. The sows often become so fat on very scanty food, that they will not breed: they are extremely tender, and if they happen to have litters in winter, it is difficult to save the young pigs from dying in cold nights. A cross of the Neapolitan with some of our hardier breeds greatly improves their usefulness, without injuring their aptitude to fatten: the best cross is with the Berkshire, which is a well-shaped hog (*Fig.* 2), with short legs, small ears, broad chines and loins, and good hams.

" From the prolific nature of the hog, it is not difficult to select the

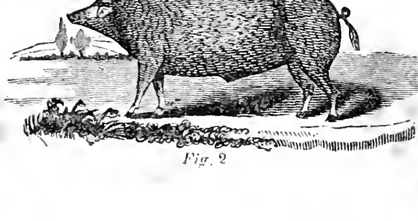


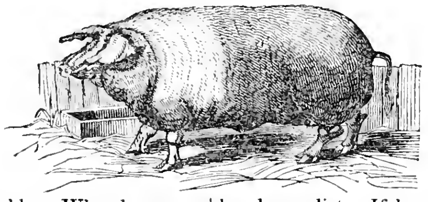
Fig. 2

best individuals to breed from. In every litter there will be pigs better formed than the generality, and by careful selection of these any breed may be soon much improved without crossing; but experience teaches that when the sows and boars are too nearly related, the fecundity gradually diminishes; and by continually breeding from the same stock the sows at last produce only two or three diminutive pigs at a litter. Hence the advantage of frequent crossing. To restore fecundity no breed is so effectual as the Chinese. A breed compounded of the Berkshire, Chinese, and Neapolitan may, by careful selection, produce every quality which can be desired; numerous litters, early fatting, and fine hogs for bacon at twelve or sixteen months old, are the result of care and judicious breeding. *Fig*. 3 represents the Bedford or Woburn hog. It is large, hardy, and well-formed, generally white, variously spotted, with small limbs and head, and fattening rapidly.

"The black hogs are preferred, on the whole. They are much less subject to diseases of the skin than the white, and the sun affects them less in summer. For sucking pigs or porkers many prefer the white, merely for the appearance, for the black skin is in general the finest.

"There are some very large breeds, which have been recommended under the idea that, in a large hog, the bone and offal are less in proportion to the flesh than in a smaller. But these large breeds do not come so soon to maturity. They cannot be profitably put up to fatten till eighteen or twenty months old, or more; and although some of them may make hogs of thirty or forty score when killed, they are so long fatting, and reqnire so much food, that it is very doubtful whether they pay for it as well as the smaller. For delicate bacon, the hogs killed at a twelve-month old, and weighing ten or twelve score, are much preferred, and we are inclined to think that they

Fig. 3.



are most profitable. When hams are the principal object, the hogs should be killed before they are so fat as they might be; and the carcass is then cut up and pickled, instead of being converted into dry bacon. To keep hogs profitably, a regular system should be pursued both in the breeding and feeding. Proper hog-sties should be constructed with chambers, in which the pigs of different ages and the breeding sows may be kept separate. The food should be prepared for them by boiling or steaming in an apparatus conveniently placed, and the greatest cleanliness and regularity should be maintained. It is a great mistake to suppose that the hog loves dirt. If he can keep himself clean he will do so; and the wallowing in the mud is not from a love of dirt, but from a heat and itching in the skin in warm weather, which is relieved by rolling in the cool mud If hogs have plenty of clean straw and clean water they never will be dirty, and nothing makes them thrive so quick or pleases them more than being washed and curried regularly. If the hogs are not closely confined, they will always lay their dung at a distance from the place where they sleep or feed, and in all well-constructed sties there should be a small yard to each apartment in which the hogs can deposite their dung.

"When a sow is near the time of farrowing, which is four months after she has taken the boar, she should be put in a sty by herself, with a moderate quantity of straw, for if there be too great an abundance she is apt to lie down on the young pigs when they bury themselves in the loose straw. Sows, although very careful of their pigs, are very apt to lie on them, especially when any of them are near a wall: to prevent this, it is very useful to have a ledge of wood six inches wide, and six inches from the ground, all round the stye, so that she cannot lie down close to the wall; and if a young pig should be accidentally behind her, he can take refuge behind the ledge, and thus escape being lain upon. When no precautions are taken, one fourth of a litter is often lost in the first day or two after they are born. Some sows have the unnatural propensity of eating their young pigs as soon as they drop: good feeding will prevent this in some measure, but attention at the moment of farrowing is the safest and surest preventive. When once the young pigs have sucked, much of the danger is past.

"A sow with many pigs should be well fed; bran and meal, with milk or whey, are the best food; grains, where they are at hand, are excellent; and it is useful to let the sow go out to graze in a meadow or clover field for an hour or two every day, shutting up the pigs during that time till they are a fortnight or three weeks old, when they may accompany the sow. A sow will live many years, and bring numerous litters, and the older she is the better nurse she is in general. When a sow has ten or twelve pigs at a litter, and two litters in the year, one in spring and another in autumn, she is too valuable to be killed, and ought to be kept as long as she will breed. But otherwise it is very profitable to let a young sow have a litter at ten months old, and spay her immediately; she will then fatten most readily as soon as the pigs are weaned, and the bacon will be as good as that of a maiden pig. Whenever a sow does not bring a sufficient number of pigs, or is not a good nurse, or has ever eaten any of her pigs, she should be spayed and fattened immediately. The young pigs intended to be kept for stores or for porkers are castrated or spayed at a month or six weeks old. The males are then called *barrow* pigs, and when fatted make the best bacon. They are usually put up at a twelvemonth old, and fatted in three or four months. At first they have potatoes raw or boiled; pumpkins, artichokes, apples, brewers' grains, are all excellent mixed with bran, or bean meal, or they have dry beans and water. After they are half fat they should have pease meal, corn meal, flax meal, and water, unless in a dairy, where they have the skimmed milk or whey. Hogs fattened on potatoes only do not make so good bacon as those which are fatted on corn. Potatoes are an excellent food for store pigs, and may be given boiled and mixed with meal in the early part of the fatting process; but beans and pease make the firmest flesh, and corn meal the sweetest. Before a hog is killed he is usually fed for some time on corn meal and water alone, given as thick as porridge, and very little, if any water is given to him. This last rule is often carried to too great an extent. Much water will make the food pass through too rapidly, and it will not be digested, but the hog should never suffer from thirst, or he will not thrive. Before a hog is killed he should be kept without food for twelve hours at least; he may, however, have water. He should be killed without giving him more pain or causing more struggling than is necessary, by a resolute stab with the knife in the lower part of the neck, where the knife may sever the large artery which comes directly from the heart. The blood should be allowed to flow freely till it is all out of the body. The hog, if intended for salt pork, must then be scalded with water not quite boiling, and well scraped, to take off the hair with the cuticle; but for bacon it is best to singe the hair by burning straw over the body, and then scraping the skin. Care must be taken not to allow the skin to be burned so as to crack. The hog is then hung up, and the entrails taken out. The inside of the body is washed clean with a cloth or sponge dipped in water, that no blood may remain, and the next day the hog is cut up. The head and feet are cut off, the chine is taken out, and the upper part of the ribs, with the back bone, are cut out, leaving as much flesh as possible adhering to the fat outside. The small ends of the ribs remain attached to the bacon."

The preserved flesh of the hog is termed pork when placed in brine, and bacon when dried. The preparation of *pork* for shipping, especially to England, is a matter of importance. The following is the English method, as published by Messrs. Hitchcock & Co.:

"Pork is cut into four or six-pound pieces, according to the size of the hog. Where the carcass weighs two hundred and fifty and under, it is cut into four-pound pieces; large hogs are cut into six-pound pieces. The hog is first split through the back bone in half; then passed to the trimming-block, where the half head and legs are cut off, the leaf and tender-loin taken out, and the whole side split lengthwise through both the shoulder and ham, and as near the centre as is consistent with the proper shape and size of the different pieces. From the trimming-block the strips pass to the scales, where the weight is ascertained and called to the man at the cutting-block, who divides each strip into the requisite sized pieces. Both the splitting and piercing require skill and judgment, as much depends upon having the pieces well and sizably cut. From thence it goes to the rubbing-table, where each piece is thoroughly rubbed in salt in the same manner as in curing bacon. After the salt has been well rubbed in, it is put into pickling tubs, holding from three to five hundred pounds, well covered with salt, but no water or brine added. Here they remain from eight to ten days. It is then taken to the washing-trough or vat, where each piece is thoroughly washed in clean brine, trimmed, and *tormented*, as the process of trying is called, to ascertain that it is properly cured and free from taint. It is then messed and weighed, so that the requisite number of pieces shall weigh exactly the number of pounds for the barrel or tierce. It is then put up in the proper package, and freely salted while packing, and saltpetre added at the rate of a common wineglassful to the hundred pounds. The last layer is pounded in by a heavy iron weight, and capped with coarse salt. It is then passed to the cooper, who puts in the head, and puts on to the barrel one, and on to the tierce at least three iron hoops at each end. The package is then filled with clean strong brine, bunged tight, branded, and is then ready for market.

"The great utility of this method of curing consists in the certainty of the meat keeping in good condition for years in any climate. The blood gets all drained out of the meat before it is barreled, and hence one great cause of injury is avoided. I saw pork and beef which had been two years in the barrel, which was as sweet as when first put up, and the brine was perfectly clear. The large hogs, or heavy pork, which is uniformly cut in six-pound pieces, is packed in tierces, and is then called India or navy pork. The four-pound pieces are put in barrels.

"A barrel of prime pork should contain from 25 to 30 pieces, cut from the ribs, loins, chines, and belly pieces, all lying between the ham and shoulder, forming what is called the broadside or middle. Three hands and two hind-leg pieces, or three hind-leg pieces and two hands, and fifteen or twenty pieces from other parts of the hog, except no part of the head. The meat must be of prime quality, firm, and well fattened, cut into four-pound pieces, exactly fifty to the barrel, and weigh not less than two hundred pounds nett, and must have a good capping of St. Ubes, or other coarse salt. This is indispensable. Bacon mess pork is so called when the full proportion of prime pieces in prime mess is withheld: there are, therefore, various classes of bacon pork. Tierces contain the same number, that is, fifty pieces of six pounds, and the same rules as to messing are to be observed as in the barrel. The tierces must have not less than three hundred pounds, and well capped with salt. It is usual to put in fifty-two pieces. In bacon mess, the number of prime mess pieces should be marked upon the head. No part of the hog's head is allowed in any instance."

Bacon differs from pork in being dried. The following is the *Hampshire* method, which is in the highest repute in England, and makes the best article; the ham only is removed from the side, the shoulder and middling being allowed to remain together, and called a side or flitch of bacon:

"The hair is burned off with lighted straw, and the cuticle of the skin scraped off. The carcass is hung up after the entrails have been removed, and the next day, when it is quite cold, it is cut up into flitches. The spare ribs are taken out, and the bloody veins carefully removed; the whole is then covered with salt, with a small quantity of saltpetre mixed with it. Sometimes a little brown sugar is added, which gives a pleasant sweetness to the bacon.

"The flitches are laid on a low wooden table, which has a small raised border all round it. The table slants a little, so as to let the brine run off into a vessel placed under it by a small opening in the border at the lower end. The flitches are turned and resalted every day: those which were uppermost are put under, and in three weeks they are ready to be hung up to dry. Smoking the bacon is no longer so common as it used to be, as simply drying it is found sufficient to make it keep. Those who, from early association, like the flavour given by the smoke of wood, burn sawdust and shavings in a smothered fire for some time under the flitches; when they are quite dry, they are either placed on a bacon-rack for the use of the family, or are packed with wheat chaff into chests till they are sold.

"The practice of cutting the hogs into pieces and pickling them in a vat, being attended with less trouble, is very generally preferred when there is only a sufficient number of hogs killed to serve the farmer's family; but flitches of bacon, well cured, are more profitable for sale."

The common method in the United States is to kill in November to January, scald the carcass by immersion in a hogshead of water heated by hot stones, and rub off the bristles and scarf-skin by knives: the chine, head, and feet are also taken off.

In Virginia the side is cut into a shoulder, taken off as far down as the spare ribs, a middling and ham; it is thoroughly salted, one bushel of Liverpool salt serving for 1000 pounds of pork; this is mixed with one or two pounds of pounded nitre. The pieces are piled in a hogshead, the hams being first put in, the shoulders next, then the middlings, and on top the necks, jowls, heads, &c. There is an admirable piece, called the round, formed by cutting the neck close to the head, and again off the side by the upper spare rib. The pieces remain untouched from four to six weeks; they are then hung on laths across rafters, shank downward, and at least eight feet above the ground in the smoke-house, and a smothered fire made with corn cobs, hickory and oak chips. At first they are smoked three times a day, and later but twice. The laths are moved every week, so as to bring the different pieces nearest the smoke. As the weather becomes mild, a handful of red pepper is thrown upon the fire occasionally to annoy any insects in the smoke-house. In six weeks or two months the smoking is stopped, the pieces are taken down, rubbed with pounded red pepper, and hung again, shank upward, until dry, till

April or May. They are now taken down, exposed to the sun for a few days, rubbed again with red pepper, and if perfectly sound, are ready to be stored; this is best done in hogsheads, with fresh ashes, or in a perfectly dark dry room. Some cover the hams with canvass, and coat it heavily with whitewash, hanging them up until disposed of. Dipping the pieces in hot lye will kill maggots, skippers, and other enemies, but the salts being deliquescent, the bacon remains always damp. There is nothing superior to ashes, for it not only hinders maggots, but keeps the bacon from rats.

The Westphalian hams enjoy so much reputation, that it may be serviceable to give the method of curing; we also add the most approved English method:

"The method of curing hams in the most celebrated districts is to rub them very hard with bay or other salt, then leave them on a stone bench, in order that the brine may discharge itself. In a few days the rubbing process is repeated, about half an ounce of saltpetre (*nitrate of potassa*) being added to each ham. When they have continued about a week longer on the bench, or in the salting-tub, among the brine, they are commonly hung up to dry in the sides of large open chimneys; some have them exposed to the smoke of wood, peats, coals, or other sorts of fuel, while others carefully avoid having them smoked; and when not sold sooner, they are continued in these situations till the approach of warm weather, when they are packed up in casks with straw, or the chaff of oats, and consigned for sale. Hams lose about 20 per cent. of their weight in drying.

"Hams may be cured in order to resemble in taste those of Westphalia, by the following process: Cover a young ham of pork with dry salt; let it be for 24 hours to draw off the blood, then wipe it perfectly dry, and take one pound of brown sugar, a quarter of a pound of saltpetre, half a pint of bay salt, and three pints of salt; incorporate these ingredients in an iron pan over the fire, and stir them continually till they acquire a moderate degree of heat. In this pickle the ham must be suffered to remain for three weeks, frequently turning it, when it should be suspended in a chimney for drying by means of smoke from no other but a wood fire. The smoke from oak sawdust or shavings is the best for imparting a fine flavour. This smoke contains imperfectly-formed pyroligneous acid, which is the agent that communicates the flavour to the Westphalia hams. In Dumfriesshire the pickle for hams is sometimes made with one half ale, which renders the hams shorter, and adds greatly to the richness of their flavour. The imports of bacon and hams into England have greatly increased, the duty being reduced to 14*s.* the cwt., or just half of what it was for many years. On those imported from British colonies, the duty is 3*s.* 5*d.* On hands in pickle, 6*s.*"

"*Diseases of Hogs.*—The diseases of swine are generally the result of want of care and cleanliness, or arise from injudicious and irregular feeding, and from their being kept in loathsome and uncomfortable situations. Is it to be wondered at that they become subject to internal and cutaneous diseases! Fortunately, they will generally eat even when sick, and salts (one to two oz.), sulphur (two to three drachms), antimony, and such like aperients, may be mixed with their food for measles and similar disorders. If they will not eat, there can, of course, be no cure applied.

"In swine-pox, sulphur may be administered in small quantities, with treacle, in the wash; fresh brewer's grains, or pollard, may also be given. But for cutaneous diseases in general, an ointment formed of equal parts of mutton suet and tar, with the addition of a little sulphur, will be found beneficial.

"In cases of surfeit, indigestion, or injury from eating slightly poisonous matter, swine will refuse their food, constantly lie down, and have the stomach distended. In this case, two heads of garlic, mixed with six oz. of fresh butter, will afford relief, given every six hours.

"The most formidable of the diseases to which swine are liable is inflammation of the lungs and other internal parts; this disease has been known to destroy a fourth of the hogs in a distillery in the course of a few weeks. The chief indications of the disease will be the distressing cough, the heaving of the flanks, and the refusal of all food. Bleeding must be promptly resorted to, and moderate purges cautiously administered. The safest aperients are castor oil, or Epsom salts, after which the following powder may be given: antimonial powd., 2 grs., nitre, half a drachm.

"In cases of murrain, a species of leprosy, which prevails chiefly in hot seasons, the best advice that can be given is to keep the animal cool, and not to suffer any animal food to be given.

"The health of swine is to be estimated by their cheerfulness, by the gloss upon their coats, their skin being wholly free from eruption. If pigs snort on being disturbed, it is an excellent sign of sound health and good keep. The state of the excrement or digestions will generally indicate pretty correctly the thriving condition of the animal; for, unless these are of a firm consistence, the hog will not fatten rapidly. If store or stock pigs are kept well and in good condition, it will prevent most of the diseases to which the animals are subject, and they will also thrive and fatten at half the expense when shut up for that purpose. From the confinement of the hog, and the nature of his food, a description of indigestion takes place, with cutaneous eruptions."

HOGSHEAD. An old measure containing 63 wine gallons. A large barrel in which sugar, tobacco, and coarse produce are packed, containing from 10 to 14 cwt.

HOG'S LARD. The fat from the kidneys, over the chines, intestines, &c., is converted into lard for family use and sale. Being separated from skin and lean, it is to be put into a copper or iron boiler, with water, and melted thoroughly, being constantly stirred with a wooden bat, lest it become burned: a handful of salt is added to the 100 lbs., and stirred in; as soon as it is well boiled it is to be removed from the fire and passed through a colander and closely woven strong cloth into the wooden or earthen-ware vessels in which it is to be kept. By straining in this way, all the pieces of skin are separated. The cracklings are well pressed in the colander to obtain all the fat. A layer of salt may be placed above the top of the cold lard, the vessels closed, and stored in a cool cellar. The cracklings serve to fatten poultry, or may be kept for domestic soap.

Lard consists of 38 stearin and 62 elain in 100 parts. These are now separated for commercial purposes, the former resembling spermaceti, and making admirable candles, the latter affording the lard oil so extensively used for lamps, wool dressing, and machinery: it sells at from 75 cts. to $1 the gallon. Indeed, lard itself furnishes a good light when burned in suitable lamps with short wicks.

From the low price of hogs in the West, it has been found profitable to render the carcass, excepting the hams, into lard; the lard is subsequently divided into the oil and stearin; these processes are simple, and fully explained by the following paper of Mr. Stafford, of Cleveland, Ohio. The skin is removed from the parts steamed.

"The average Ohio hogs (common breeds) will produce, when tried by steam, 50 per cent. lard, after deducting the hams and shoulders. The plan now generally adopted is, not to take out the shoulders; the sale for them is limited, and price low; the covering of fat will produce more in lard than the expense of curing would warrant. The mixture of the China and Berkshires, fed upon potatoes or any other vegetable containing starch as a principal food, would produce, when very fat, at least 70 per cent., after taking out *only* the hams.

"The steaming apparatus is merely a tub with a false bottom, perforated with holes, lying about two inches above the bottom. The steam is introduced between the two bottoms, and so entirely separates the fat from the cells in which it was enclosed that no pressing of scraps is necessary. The bones, lean, and scrap are left on the false bottom, and the lard floats on the surface. With steam, at a pressure of five lbs. to the inch, it will require from 18 to 20 hours to try off a tubful of any given quantity, steam in proportion, of course; 60 lbs. pressure would do it in one third the time. The great advantage of steam is, the whole of the lard or tallow is produced, and there is no danger of burning either.

"The quality of the lard is good, but not equal to leaf lard or suet; the carcass fat does not contain as much of the concrete principle (stearin). Whole hog lard cannot be refined and made hard without a portion of the oil is extracted. I take from 20 to 40 per cent. of the oil; then the balance goes through several washings in pure *rain water* by steam, after which it is refined lard. The expense is not more than one quarter cent per pound, but it is of more value to us than common lard, as we have a great deal of trouble and expense with it; and in only extracting a portion of the oil we would lose by it, did it not command a better price in the market, which it should from its purity.

"The bones are worth at least half a cent per pound to calcine. From them ivory black is made (worth 2½ cents per pound), by charring them in close iron vessels.

"I used to decompose the lard in acid and neutral salts. When the affinity between the parts is destroyed, I separate them by means of canvass bags placed in powerful screw-presses. If I wish to make candles of the residue, the pressure is continued until all the oil, by this means, is forced out. The contents of the bags are then subjected to the action of a powerful hydraulic press, and the stearin pressed to dryness.

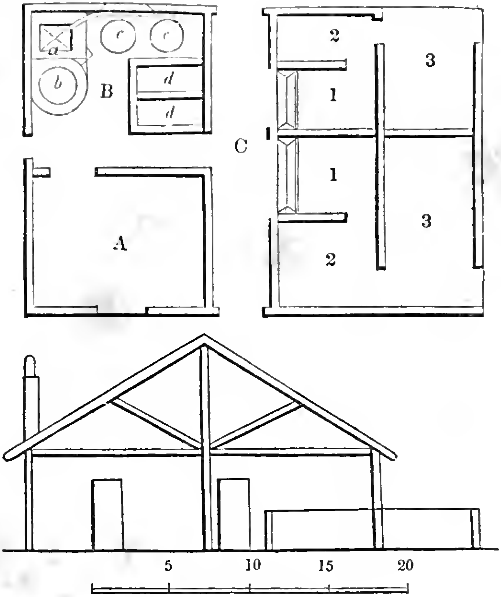
"To produce the winter oil, we have to expose the decomposed lard to the cold."

For the purpose of furnishing most oil, the hogs are fed on oil cake, cotton-seed cake, flaxseed, beech-nuts, and anything that is full of grease.

The perfect separation of the stearin of lard and suet is the subject of several patents, and belongs to the department of manufactures, as the process requires much machinery, and is full of chemical details.

Oxen and sheep are now steamed in the same way as hogs in the West for their tallow. See *Ox*.

HOG-STY. "Much of the profit of breeding and fattening hogs depends on the economy of labour in preparing their food. Any place is often thought good enough to lodge a pig in, and a sty is a word synonymous with a filthy place; but in every well-arranged farm-yard there should be a convenient place for keeping hogs and feeding them, which may be erected at a small expense, and which will soon repay the outlay. There should be a place to boil and mix the food in, with one or more large coppers, and a steaming apparatus. The food should be mixed in square brick tanks sunk in the ground and cemented, that there may be no filtrations. If there is only one tank, there should be a partition in it. From the boiling-house there should be an immediate communication with the feeding-sties, under cover, if possible. Each sty should open into a small yard behind, which should communicate by a door with the principal farm-yard, where the barn is situated, in which the corn is thrashed, and be enclosed with a low wall or paling. There should be separate sties for breeding-sows, for porkers, and for fatting hogs. Not more than three or four of the latter should be in one sty. The food should be given in troughs, in a separate compartment from that in which the hogs lie down, and no litter should be allowed



Elevation and Section.

A, Root-house ; B, boiling and steaming house ; *a*, steamer ; *b*, copper ; *c*, *c*, steaming vessels ; *d*, *d*, tanks to mix the food ; C, passage to the sties ; 1, 1, feeding-rooms ; 2, 2, sleeping-rooms ; 3, 3, yards.

there. The floor, which should be of brick or stone, should be frequently washed clean, and the troughs should be cleaned out before every meal. Any of the food left from the last meal should be taken out and given to the store pigs. A very convenient contrivance for keeping the troughs clean is to have a flap or door, made with hinges, to hang horizontally over the trough, so that it can swing, and alternately be fastened by a bolt to the inside or outside edge of the trough. When the hogs have fed sufficiently, the door is swung back, and the trough is easily cleaned out. It remains so till feeding time, when the food is poured in without any impediment from the greedy hogs, who cannot get at it till the door is swung back. This simple contrivance saves a great deal of trouble, and is easily adapted to any common sty. It is a great advantage to be able to inspect the sties without going into them, and this is effected by placing them under a common roof, which may conveniently be a lean to the boiling-house, or any other building, with a passage between them.

"The preceding figure will best explain this, and show its superiority over common sties."

Where the establishment is much larger, a passage may be run entirely through the sties, and the feeding troughs be arranged along it; the food may also be made to pass along a gutter to the various troughs.

HOLCUS. The genus of soft grasses. See *Grasses.*

HOLERACEOUS. Culinary plants, pot-herbs.

HOLLY. Evergreen shrubs, and small trees of the genus *Ilex*. The prickly Christmas holly, naturalized in Virginia, is the *I. aquifolium;* the native holly of the Middle States, often becoming a tree of 30 feet, is the *I. opaca.* The prickly holly is much used for hedges in England; a good bird-lime is prepared from the inner bark. The *I. vomitoria*, or *cassina*, is a handsome southern shrub. The decoction of the toasted leaves is the Indian black drink: it is emetic.

HOLM. A marshy place or island.

HOLM, or HOLLY OAK. *Quercus ilex*, a European species.

HOLY GRASS. *Holcus odoratus.* See *Grasses.*

HOMESTEAD. The regular arrangement of farm buildings.

HOMMINY. Corn, usually of the smaller white flint kinds, bruised in a mill or mortar until the external covering is removed, and then sifted.

HOMOGAMOUS (from *ὁμον, together*, and *γαμος, marriage*). When all the florets contain both sexes.

HOMOGENEOUS (from *ὁμον*, and *γενος, kind*). Bodies, all the parts of which are similar in composition.

HOMOLOGOUS (from *ὁμον*, and *λογος, ratio*). Having the same ratio or proportion.

HOMOPTERANS, HOMOPTERA (from *ὁμον*, and *πτερον, a wing*). The name of an order of insects, including those in which the wing-covers are of a uniform semi-membranous consistency. Latreille divides this order into the three following divisions, viz.:

1. The *Cicadariæ*, having the tarsi three-jointed and the antennæ very short, terminated by a fine bristle.

2. The *Aphidians*, having the tarsi two-jointed and the antennæ longer, without a terminal bristle; containing the families *Aphidæ* and *Psyllidæ*.

3. The *Gallinsecta*, having the tarsi one-jointed, terminated by a single claw. The males have two wings, and are destitute of a mouth; the females are wingless, and furnished with a sucker.

HOMOTROPAL (from *ὁμον*, and *τρεπω, I turn*). In botany, having the same direction as the rest of the plant, or that part to which it belongs.

HONEY. The fluid stored by bees; it is collected from flowers and honey-dew. The colour and flavour depend upon the age of the bees, and their food; white clover and some aromatic plants of the sage family yield the best. Chemically, it consists of glucose, mannite, gum, wax, colouring matter, and albumen. When mixed with water it readily ferments; a liquor is made in this way called mead. See *Bee.*

HONEY-DEW. An exudation of sweet gummy matter from the leaves of plants, especially the oak, beech, linden, and hop. Curtis and Willdenow, with many other naturalists, attribute it to the excretions of innumerable plant lice, *Aphidians;* but Sir J. E. Smith and others to the exudation of sap during very moist hot weather, especially when the sky is overcast, hindering evaporation from the leaves. If the honey be washed off by rain or by watering, the plant usually survives; but if it becomes caked on the leaf by hot weather, it is killed. Bees flourish exceedingly on honey-dew. The plants of a well-drained soil are much less liable to honey-dew than those in damp places.

HONEY LOCUST. *Gleditschia triacanthos.* Three-thorned locust. A large leguminous tree. It is very common in the western forests of Ohio, Kentucky, Tennessee, &c., on rich bottoms, where it is one of the largest trees. The pods furnish a sweet but nauseous pulp. The wood is porous, but hard; it is inferior for cabinet purposes, and rarely used, except for posts and rails. The young plants are recommended by some for hedges, and are to be often pruned: they form a good hedge, but are apt to throw out shoots from their roots to a considerable distance from the stem.

HONEY-STONE. A rare mineral, mellate of alumina, belonging to the class of ambers and lignites, found only in Thuringea.

HONEYSUCKLE. Climbing plants of the genus *Lonicera*, &c.

HOODED. *Cucullate.* A descriptive term in botany, to express the partial covering of a flower, &c., by a petal or leaf, which is curved over it.

HOOF. The solid or cloven nail of the feet of cattle or horses; it resembles horn in composition. Hoofs are used in the manufacture of glue and Prussian blue; scraped into shreds, they form admirable manure, yielding 15 per cent. nitrogen in the natural state, or upward of 18 per cent. ammonia during decay. Four hundred pounds in compost will be sufficient for an acre.

HOOP. The wooden or metallic fastening of casks. Hickory is in the greatest esteem for this purpose; but young trees of ash, oak, birch, &c., answer well. Several machines have been patented for splitting hoops; they are, however, expensive. The usual principle is to pass the wood between rollers, which carry it upon a sharp edge that splits it centrally; motion is given to the rollers by horse power.

HOOVE, or HOVEN. See *Ox*.

HOPPER. The receiver of a mill or machine in which the grain, roots, &c., are placed.

HOP-OAST. A kiln used for drying hops. The floor of the kiln is generally of wire cloth, and the heat is generated in a stove with flues below. The hops, after being put on the kiln, are frequently turned, and in general they are rendered sufficiently dry in the course of a few hours; when dried, they are taken to a loft and left to cool for a day or two, and then put into bags, having been previously subjected to the slight action of the fumes of burning sulphur (sulphurous acid), by which they are, to a certain extent, bleached. This is not to be recommended, for it partially destroys the fine odour.

HOPPLE. A mode of fettering the legs of horses and cattle turned out to graze.

HOPS. *Humulus lupulus:* family *Urticaceæ*. The following is chiefly from Mr. Rham:

"Hops are extensively cultivated for the flowers, which give flavour and permanence to beer, by being boiled with the wort in brewing They impart a pleasant, bitter, and aromatic flavour, and prevent the too rapid progress of fermentation. Beer which is well hopped will keep long and become very fine, without any of those artificial means of fining which make the common brewer's beer so much inferior in quality to that which is home-brewed.

"The hop is a slender climbing plant, with a perennial root, which requires careful cultivation. It is very tender, and the produce is precarious, sometimes giving a great profit to the grower, and at other times failing altogether. The soil of a hop garden must be rich to a considerable depth, or made so artificially. The subsoil must be dry and sound; a porous rocky subsoil, covered with two or three feet of good vegetable mould, is the best for hops. The exposure should be towards the south, on the slope of a hill, or in a well-sheltered valley. Old rich pastures make the best hop gardens. They should be dug two or more spits deep, and the sods buried at the bottom, where they will gradually decay and afford nourishment to the slender roots of the plants, which strike deep. A very large quantity of the richest rotten dung, at least 100 cubic yards per acre, should be well incorporated with the soil by repeated ploughings, till it is entirely decomposed, and produces that dark tint which is the sure sign of an abundance of humus. The ground should be prepared by laying it up with the spade in high ridges before winter, to expose it as much as possible to the mellowing influence of the frost. A succession of green crops, such as rye, cut green or fed off with sheep, or clover, are an excellent preparation, by cleaning the land. It is better to be two, or even three years, in preparing the ground and getting it perfectly clean, than to plant the hops in a foul or unprepared soil.

"The young plants are raised in beds, and may be raised from seed; but it is more usual to plant the young shoots which rise from the bottom of the stems of old plants. They are laid down in the earth till they strike, when they are cut off and planted in the nursery-bed. Care must be taken to have only one sort of hops in a plantation, that they may all ripen at the same time; but where there are very extensive hop grounds it may be advantageous to have an earlier and a later sort in different divisions, so that they may be picked in succession. The varieties most esteemed are the grape hop, the white vine, and the golden hop. The ground having been prepared for planting, it is divided by parallel lines, six or more feet apart, and short sticks are inserted into the ground along these lines at six feet distance from each other, so as to alternate in the rows, as is frequently done with cabbage plants in gardens. At each stick a hole is dug two feet square and two feet deep, which is filled lightly with the earth dug out, together with a compost prepared with dung, lime, and earth, well mixed by repeated turning. Fresh dung should never be applied to hops. Three plants are placed in the middle of this hole six inches asunder, forming an equilateral triangle. A watering with liquid manure greatly assists their taking root, and they soon begin to show runners. A stick, three or four feet long, is then stuck in the middle of the three plants, and the runners are tied to these with twine or bass, till they lay hold and twine round them. During their growth the ground is well hoed and forked up around the roots, and some of the fine mould is thrown around the stems. In favourable seasons a few hops may be picked from these young plants in the autumn, but in general there is nothing the first year. Early in November the ground is carefully dug with the spade, and the earth being turned towards the plants, is left so all the winter. Beets, potatoes, &c., are grown in the intervals between the plants.

"In the second year, early in spring, the hillocks around the plants are opened, and the roots examined. The last year's shoots are cut off within an inch of the main stem, and all the suckers quite close to it. The suckers form an agreeable vegetable for the table, dressed like asparagus. The earth is pressed round the roots, and the cut parts covered so as to exclude the air. A pole about twelve feet long is then firmly stuck into the ground near the plants; to this the runners are led and tied as they shoot, till they have taken hold of it. If, by any accident, the runner leaves the pole, it should be carefully brought back to it and tied till it takes hold again. A stand ladder should be at hand to do this, when the runner has acquired some height. The ground being well hoed and the earth raised round the plants, the produce this year will average four cwts. per acre, if the season is favourable.

"Some hop planters plough up or dig the ground before winter; others prefer doing it in spring, in order not to hasten the shooting, which weakens the plants. The same operations of pruning the shoots, manuring, and placing poles, which were performed the preceding year, are carefully repeated. Particular attention is paid to proportion the length of the poles to the probable strength of the runners; for if the pole is too long, it draws up the runner, and makes it bear less; if it is too short, the runners entangle when they get beyond the poles, and cause confusion in the picking. In September, the flower containing the seed will be of a fine straw colour, turning to a brown; it is then in perfection. When it is over-ripe, it acquires a darker tint. No time is now lost, and as many hands are procured as can be set picking. In the picking, the poles are taken down, and the stems cut three feet from the ground; if they were cut shorter it would weaken the root, by causing it to bleed. The poles are laid sloping over a frame of strong wood, nine feet long and four feet wide, supported by legs three feet high; this is called a bin. A piece of coarse bagging is fixed to this frame by hooks, so as to form a bag which does not reach the ground. Three men or women, or four boys or girls, are placed on each side of the bin, and pick the hops from two poles at a time. Where they are very careful of the quality of the hops, they divide them into three sorts: the green, which are not quite ripe; the light yellow-brown, which are in perfection; and the very dark, which are past their prime. The dew should be off entirely before they begin; for otherwise the hops might become musty, or take too long in drying, and lose their fragrance. The hops, when picked, are dried on a cloth in a kiln. When they appear sufficiently dry at bottom, they are turned; it is, however, thought by some hop-driers that the turning of the hops is apt to injure them, and that it is best not to do so; but, in order that the upper part may be dried equally with the lower, a wooden cover, lined with tin plates, is let down over the hops on the hair cloth, to within a few inches of the surface; this reverberates the heat, and the whole is dried equally. The heat must be carefully regulated, in order that it may not alter the colour. When the leaves of the hops become brittle and rub off easily, they are sufficiently dried. They are then laid in heaps on the floor, where they undergo a very slight heating. As soon as this is observed they are *bagged*. This is done through a round hole, twenty-five or thirty inches in diameter, made in the floor of the loft where the hops are laid. Under this hole is a bag, the mouth of which is drawn through the hole and kept open by a hoop, to which it is made fast. The hoop is somewhat larger than the hole, and the bag remains suspended; a handful of hops is now put into each corner of the bag, and there tied firmly by a cord. A bushel or two of hops are put into the bag, and a man gets into it to tread the hops tight. The bag does not reach the floor below. As the hops are packed by the feet, more are continually added till the bag is full. It is now taken off the hoop, and filled up with the hands as tight as possible. The corners are stuffed as soon as the mouth is partly sewn up, and tied, as the lower corners were; when sewed close and tight, it is stored in a dry place till the hops are wanted for sale.

"The crop of the third year will average eight cwt. per acre. In some very extraordinary seasons, on good land, fifteen cwt. have been picked per acre: in Flanders, where they manure with urine and the emptyings of privies, this is not an uncommon produce. The plantation lasts fifteen to thirty years.

"Rape cakes, malt dust, woollen rags, horn shavings, and nitrogen manures are used with good success in hop grounds: bones have been tried, but with an uncertain result.

"The hop is a diœcious plant (*Fig.*), *i. e.*, some of the individuals are male plants, and others female, which have

respectively flowers of a different construction and of different habitudes. The male or staminiferous flowers (*a*), which grow on stalks quite distinct from the female flowers, prepare the pollen, or fertilizing dust, and afterward wither away, when this dust has escaped from the anthers, and been committed to the air, to be by it conveyed to the female flowers. The female flowers are in the form of strobuli (*b*) or cones, consisting of scales, which have at their base the germ of the future seed, and which have the habit of enlarging, as the scales of the fir-cones do, more particularly after the fertilization of the ovule, or future seed, by a quantity of the pollen falling upon it.

"Though the pollen, from its extreme lightness, can be wafted to a considerable distance, and some seeds in each cone may be so fertilized, yet it would be well to rear a number of the male plants among the others, or along the hedges of the hop gardens, to ensure the fertilization of *all* the seeds. But as the farmers observe that the flowers of the male (termed, in Kent, seedling, blind, or wild hop; in Sussex, buck or cock hop) wither away, they generally extirpate them at the digging season, as unfruitful cumberers of the ground. That this is an error may be proved in various ways, but an appeal to the result of an opposite practice is the most convincing. A bushel of hops, collected from plants of the fourth year, raised from seed, weighed 36 pounds, there being male plants near; a second instance, where the plants were raised from cuttings, weighed thirty-five pounds, while a bushel, grown in a garden where the male plants were always eradicated, weighed only 22 pounds. Besides the greater quantity of hops thus obtained, the aroma is much greater (the *lupulin*, on which the aroma depends, is considered by Planché to be the unappropriated pollen dust which has alighted on the scale of the females), and the strength of the bitter much greater. The value of a specimen of hops depends upon the amount of lupulin dust it contains, and its aroma; when of the best quality, they command from sixteen to twenty cents the pound. After the period when the males have elaborated the pollen, and the strobuli of the females begun to enlarge, the males may be cut down, and the stalks employed to make cordage for hop-bags against the following harvest. In 1760 the Society of Arts awarded premiums for cloth made from the hop runner.

"The poles of oak, ash, larch, and chestnut are the most durable. They should be put into a shed during winter: where this cannot be done, they are placed on end in the form of a cone, leaning against each other." The hop is very liable to diseases: it suffers from the aphis; a species of haltica attacks the young plant; several moths deposit their eggs upon it: honey-dew is often destructive; it is also liable to attacks of mildew and fire-blight towards maturity.

HORDEIN. The impure starch of barley.

HORDEUM. The genus of barley grasses.

HOREHOUND. *Marrubium vulgare.* A perennial, labiate plant, of a bitter, aromatic taste, used as a popular remedy in colds, and to flavour candies. It is readily propagated by dividing the roots.

HORIZONTAL. Level. A plane parallel to the horizon.

HORN. Indurated skin, consisting, for the most part, of modified albumen. It resembles hair in its chemical and agricultural properties, and when shaved into thin strips, answers the same purpose as a manure. Horn, whalebone, tortoise-shell, which are all similar, are readily softened by heat or hot water, and are then variously cut or moulded into a number of articles, as combs, handles for knives, rings, &c. Digested with water in an iron cylinder, under pressure, they are dissolved, and yield glue.

The horns of oxen and many other animals are only a covering over a bony process rising from the front bone of the head. This bone, called the horn pith, is remarkably porous, and full of blood-vessels, so that, when it is cut or injured, violent hæmorrhage follows, which can scarcely be stopped, except by applying a white-hot iron, or by pressure.

HORNBEAM. A tree of the same family as the oak, the *Carpinus betulus*, of small size, and formerly used as tall hedging. The wood is very hard and durable, and used by turners for cog-wheels, presses, levers, and stout handles. The only American species is the *C. Americana*, water beech, or hornbeam. It grows on the margin of rivers in the Middle States, rising twenty to forty feet.

The term hornbeam, or ironwood, is also applied to the *Ostrya Virginiaca*, a tree of twenty to forty feet high, of the same family, found in the Southern States. The wood is as serviceable as that of the hornbeam.

HORNBLEND. A dark green or black mineral, massive or crystallized in prisms, of glassy lustre, and readily scratched by a knife. It is very abundant in primary, transition, and trap formations, and consists of silica, 46; lime and magnesia, 34; iron, from 4 to 7; alumina, &c., 13 per cent. It forms the basis of numerous minerals, and is found in several varieties, as augite, amphibole, pargasite, tremolite, actinolite.

Hornblend slate and schist are transition rocks, consisting of a mixture of hornblend, quartz, and sometimes feldspar. A soil formed from these rocks is necessarily rich, from containing lime, magnesia, potash, clay, and sand. The crystals also occur in siennite, or Boston granite. Greenstone, the common ingredient of dikes, is a mixture of hornblend and feldspar, varying but little from trap. Soils rich in hornblend have a greenish colour.

HORNBUG. The beetles of the genus *Lucanus*, or stag beetles, especially *L. caprcolus*. The grubs live in the trunks and roots of old trees.

HORN DISTEMPER. A disease of the horns of oxen, especially cows, in which an accumulation of pus takes place in the pith: the treatment is, to let it out by boring into the horn, two inches from the head, with a small gimlet. The animal affected first exhibits the signs of a cold, the eyes become dull, the appetite diminishes, the creature languishes and lies down; but it is also occasionally attended with symptoms of diseased brain; the animal tosses his head and groans much.

HORN PITHS or FLINTS. These answer in manuring for bones, having a composition nearly identical with bones, namely, gelatin and fat, 36; bone earth, 54 per cent.: they decay more rapidly from their porous structure. They are difficult to crush in the common bone mill, but may be broken by a heavy bark mill, or dissolved in strong acid. They are much used for the extraction of size and glue.

HORNET. *Vespa maculata*, the American species. They build a globular nest of a substance like paper upon branches of trees, &c. Its sting is painful, but may be allayed by oil, with a little hartshorn. It preys upon fruit, flies, and is very destructive to bees. The European species is *V. crabro.*

HORNSTONE. A flinty mineral. Chert, also, is known by this name. Hornstone is wrought in stones for crushing flints in potteries; it also forms a good hone. The varieties are variously coloured, gray, white, red, and dark greenish; it is infusible before the blow-pipe, and contains 76 per cent. silica, with 13 alumina, colouring oxide, and water.

HORSE. "*Natural History and Dentition of the Horse.*—The native country of the horse is unknown. From very remote periods he has been found in almost every part of the Old World, but his appearance on the continents and the islands of the New World, whether of the Atlantic or Pacific Ocean, is of comparatively recent date. Everywhere he is recognised as the most useful of the servants of man, and he yields in intelligence to the dog alone. If he differs in different countries in form and in size, it is from the influence of climate and cultivation; but otherwise, from the war-horse, as he is depicted on the friezes of ancient temples, to the stately charger of Holstein and of Spain, or from the fleet and beautiful Arabian to the diminutive Shetlander, there is an evident similarity of form and destination which clearly stamps his common origin.

"He is naturally, and of choice, an herbivorous and granivorous animal. His thin and muscular lips, his firm and compressed mouth, and his sharp incisor teeth, are admirably adapted to seize and to crop the grass; a provision is given in the structure of some of the bones of the face, by means of which he can comminute and grind down his food as perfectly as in the best-contrived mill.

"The teeth of the horse require some lengthened consideration, not only from their admirable adaptation to this purpose, but as indicating, by the various changes which they undergo, almost beyond the possibility of error, the age of the animal. He may, when young in years, be reduced nearly to the decrepitude of age by the barbarous usage of those who ought to be his most zealous protectors; the cavity above the eye may be deepened, the under lip may fall, the limbs may be bowed, and the feet may be battered and distorted, but it is not easy to alter the character of the teeth.

"The colt is generally dropped with the first and second molar and grinding teeth having forced their way through the gum. When he is about seven or eight days old the two central front, or incisor teeth, above and below, appear (*Fig. a*). At the expiration of five or six weeks the two next incisors may be seen. At three months they will have overtaken the central ones, and both pairs will have nearly attained their natural level. A third grinder will then have appeared; and a little before or after the eighth month the third nipper, above and below, and on each side, will be seen. The colt will now have his full complement of front or cutting teeth.

"These teeth are beautifully adapted to their purpose. They have in front an elevated cutting edge of considerable sharpness. It is formed of enamel, a polished substance almost too hard to be acted upon by the file, which covers the tooth. This elevated edge is bent somewhat inward and over the tooth, so that there is a depression behind it, which gradually becomes stained by the food, and constitutes what is called 'the mark' in the mouth of the colt or horse.

"This elevated edge of enamel, hard as it is, is gradually worn down in the act of nipping and cutting the grass; and as it wears away, the hollow behind becomes diminished, and is at length totally obliterated. By the degree in which this mark is effaced, the horseman, not only with regard to the first, but the permanent teeth, judges of the age of the animal. This obliteration begins to be manifest at a very early age. At six months it is sufficiently evident in the four central nippers. At a year and a half the mark will be very faint in the central nippers, diminished in the other two, and the surface of all of them will be flattened.

"At twelve months a fourth grinder protrudes, and a fifth at the expiration of two years.

"These are all temporary teeth. They were only to last during a very early period of the life of the animal; and when his jaws were considerably expanded, they were destined to give way to another set, larger, firmer, and that would probably last during life. The permanent teeth had been long growing in the socket beneath the temporary ones, and had been pressing upon their roots, and that pressure had caused an absorption of these roots, until at length they lost all hold, and were displaced.

"When the animal is about three years old the central pair of nippers, above and below, are thus removed, and two fresh teeth, easily distinguishable from the first by their increased size, make their appearance, so that a three-year old colt is easily recognised by these two new and enlarged central nippers.

"A three-year old colt has his form and energies much more developed than a two-year old one, and is considerably more valuable; therefore some dishonest breeders endeavour to pass him upon the unwary as being a year older than he really is, and they accomplish this in an ingenious but cruel manner. This cannot, however, be effected until a portion of the second year is past, when the permanent teeth below are beginning to press upon the roots of their predecessors, and then the breeder extracts the central milk-teeth. Those below, having no longer anything to resist their progress, grow far more rapidly than they otherwise would do, and the scoundrel gains four or five months in the apparent age of his colt.

"Can this trickery be detected? Not always, except by him who is well accustomed to horses. The comparatively slow wasting of the other nippers, the difference of the development of these nippers in the upper and under jaw—for the breeder usually confines his roguery to the lower jaw, the upper one being comparatively seldom examined — these circumstances, together with a deficiency of general development in the colt, will alone enable the purchaser to detect the attempted cheat.

"The honest mouth of a three-year old horse should be thus formed: the central teeth are palpably larger than the others, and have the mark on their upper surface evident and well defined. They will, however, be lower than the other teeth. The mark in the next pair of nippers will be nearly worn away, and that in the corner nippers will begin to wear (*Fig.* 3).

"At three years and a half the second nippers will be pushed from their sockets, and their place gradually supplied by a new pair; and at four and a half the corner nippers will be undergoing the same process. Thus, at four years old the central nippers will be fully grown; the next pair will be up, but will not have attained their full height; and the corner nippers will be small, with their mark nearly effaced. At five years old the mark will begin to be effaced from the central teeth, the next pair will be fully grown and the blackness of the mark a little taken off, and the corner pair will be protruding or partly grown.

"At this period, or between the fourth and fifth year, another change will have taken place in the mouth; the tushes will have begun to appear (*Fig.* 5). There will be two of them in each jaw, between the nippers and the grinders, considerably nearer to the former than the latter, and particularly so in the lower jaw. The use of these tushes in the domesticated state of the horse is not evident; but they were probably designed as weapons of offence in the wild state of the animal. Attempts are too frequently made to hasten the appearance of the second and the corner teeth, in the same manner as described with regard to the first, and the gum is often deeply lanced in order to hasten the appearance of the tush.

"At six years old the mark on the central nippers will be diminished, if not obliterated. A depression and a mark of rather brown hue may remain, but the deep blackened hole in the centre will no longer be found. The other incisors will also be somewhat worn, and the tush fully developed.

"At seven the mark on the next pair of incisors will have nearly disappeared, and the tush will be rounded at the point and the edges.

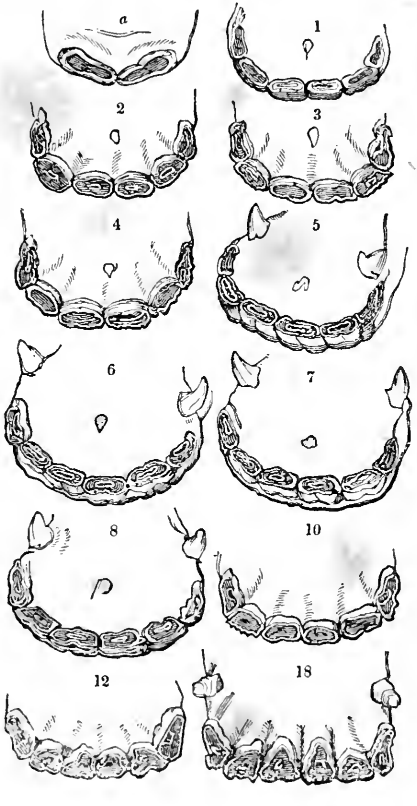
"At eight the mark will have disappeared from all the incisor teeth, and the tush will be evidently rounder and blunter.

"At this period another piece of trickery is occasionally practised. The breeder had, until the animal was five years old, been endeavouring to give him an older appearance than his years entitled him to, because in proportion as he approached the period when his powers were most perfectly developed his value increased; but now he endeavours to conceal the ravages of age. The horse is cast, and with a sharp-pointed steel instrument a little hole is dug on the surface of the corner incisor, to which a red-hot iron is afterward applied. An indelible black mark is thus left on the tooth. Sometimes the roguery is carried farther; the next tooth is slightly touched with the engraver and the cautery; but here the dishonest dealer generally overreaches himself, for the form and general appearance of a six-year old horse can rarely be given to one who has passed his eighth year. The eighth year having passed, it is difficult to decide on the exact age of the horse. The incisors of the upper jaw are then the best guides. At nine years the mark is said to be worn away from the central teeth; at eleven, from the next pair; and at twelve, from the corner ones. The tush likewise becomes shorter and blunter.

"There are many circumstances which render a decision as to the age of the horse very difficult after the marks are effaced from the lower incisors, and even before that period. Horses always kept in the stable have the mark much sooner worn out than those that are at grass, and it is impossible to form any calculation at all as to crib-biters.

"Of the age to which the horse would naturally arrive it is impossible to say anything satisfactory. Many have exceeded thirty, and some of them even forty years; but, from ill-usage and over-exertion, the majority come to their end before they have seen 15 years."

"The various progressive changes that take place in the appearance of the teeth of horses at different ages, from a few weeks old (marked *a* in *Fig.*) to 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, and 18 years, may be seen in the following dental map, constructed by Mr. Blaine."



"*The Proper Conformation of the Horse.*—A very general account only can be given of this, for it varies essentially with the breed and destination of the animal. There are some points, however, which are valuable in horses of every description. The head should not be disproportionally large, and should be well set on, *i. e.*, the lower jaw-bones should be sufficiently far apart to enable the head to form that angle with the neck which gives free motion and a graceful carriage to it, and prevents its bearing too heavy on the hand. The eye should be large and a little prominent, and the eyelid fine and thin. The ear should be small and erect, and quick in motion. The lop-ear indicates dulness or stubbornness; and when it is habitually laid too far back upon the neck, there is too frequently a disposition to mischief. The nostril in every breed should be somewhat expanded: it can hardly be too much so in the racer, the hunter, the roadster, and the coach-horse, for this animal breathes only through the nostril, and would be dangerously distressed when much speed is required of him, if the nostril could not dilate to admit and to return the air. The neck should be long rather than short. It then enables the animal to graze with more ease, and to throw his weight more forward, whether he is in harness or galloping at the top of his speed. It should be muscular at its base, and gradually become fine as it approaches the head. The withers should be somewhat high in every horse, except, perhaps, that of heavy draught, and it does not harm him, for there is larger surface for the attachment of the muscles of the back, and they act at greater mechanical advantage. A slanting direction of the shoulder gives, also, much mechanical advantage, as well as an easy and pleasant action, and a greater degree of safety. It must not, however, exist in any considerable degree in the horse of draught, and particularly of heavy draught. The chest must be capacious, for it contains the heart and the lungs, the organs on which the speed and endurance of the horse depend. Capacity of chest is indispensable in every horse, but the form of the chest admits of variation. In the wagon-horse the circular chest may be admitted, because he seldom goes at any great speed, and there is comparatively little variation in the quantity of air required; but in other horses the variation is often fearful. The quantity of air expended in a gallop is many times that required in hard work. Here we must have depth of chest, not only as giving more room for the insertion of the muscles on the action of which the expansion of the chest depends, but a conformation of the chest which admits of that expansion. That which is somewhat straight may be easily bent into a circle when greater capacity is required; that which is already circular admits of no expansion. A few words more are all that our limits permit us to add, and they contain almost all that is necessary to be added on the conformation of the horse. 'The loins should be broad, the quarters long, the thighs muscular, and the hocks well bent and well under the horse.'"

Varieties of the Horse.—All the varieties are attributed by naturalists to one common origin, either of Tartary or Arabia, the diminutive size of the Shetland, Iceland, and other ponies being attributed to climate and provender.

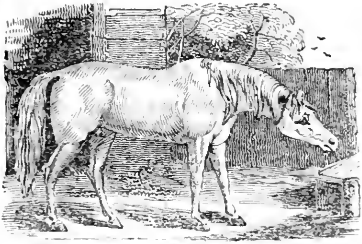
As our breeds are derived from Europe, it being asserted that the wild Mexican and Pampas horses are the offspring of those introduced by the Spaniards and early settlers, it will be well to make some remarks on the original stock.

William the Conqueror introduced Spanish horses (of Arabian stock) into England. The thorough Arabian was introduced in 1121.

The Arabian horse is of small size, usually of a dark or black colour, fine eye, neat limbs, and amiable disposition; his form is the model for endurance and speed. Several Arabians have been introduced into the

United States, one of which is now in Virginia. The figure represents

Fig. 1.

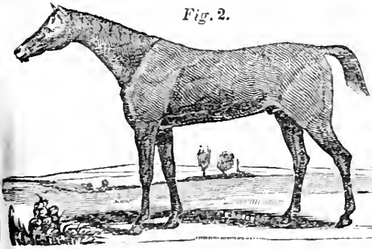


an Arabian brought to Paris by Napoleon, and now in the Royal Garden.

From this breed the finest horses of Spain, Barbary, France, and Germany have been improved.

The race-horse is a well-marked animal, derived from a judicious mixture of the Arabian, Persian, and Barbary; it is, therefore, formed out of Arabian varieties entirely. His figure indicates swiftness, which has even reached four miles in seven and a half minutes in the case of Fashion. The same characteristics belong to the American thorough-bred, which has, indeed, been derived from the best English stock, and crossed with the thorough Arabian. It is the opinion of those best informed, that this breed is now beyond the Arabian, and can only be improved by judicious selections from the same stock.

Fig. 2.

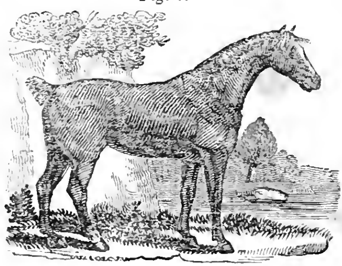


See *Breeding*. The figure represents the characters of the racer remarkably well.

The hunter is three quarters bred, fifteen to sixteen hands high, with more bone, and shorter in the body than the turf horse. His forehead should be lofty, the shoulder high, but thicker than in the race-horse: a broad chest is indispensable. The leg deeper, but shorter than that of the racer. The foot is all-important; it should stand upright, or a little outward; the loins must be broad, the thighs muscular, the hocks well bent and under. Dr. Gibson is of opinion that the Irish racer, though not so highly bred, is now a better horse than the English racer: of this stock Harkaway and Skylark, introduced into Virginia, were the finest specimens. The horses of Virginia and New-Jersey, gotten by Shark and Tallyho, out of the best common mares, are fine hunters and improved hacks.

The improved hack, or roadster, is the most important horse. It is now in England of the same breed as the hunter, being preferred rather for the figure than any other quality. In selecting breeding stallions and mares, those with high and well-placed shoulders, light heads, and moderate necks, with straight legs, and full hunting hind quarters, are selected. Such an animal is safer, and possesses all the bottom of the hunter. These points are well shown in the figure.

Fig. 3.



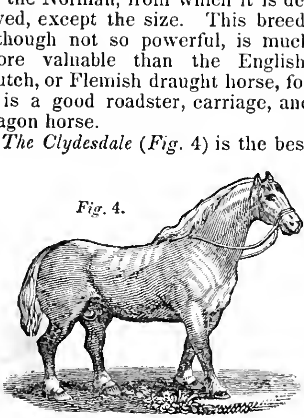
It is a difficult thing to place the *New-York trotters;* for while, by their speed, they are entitled to the rank of racers, their bottom and figure place them in the list of roadsters.

The Morgan or Goss horse of Vermont occupies a position between the thorough roadster and draught horse. They are fourteen to fifteen hands, bay, short and round, small heads, deep chests, fore-legs set wide apart, strong backs, good wind and bottom. They are spirited, with good action and form, and an admirable roadster and carriage horse.

The Norman horse, or *Percheron*, is a cross of the Spanish upon the Flemish draught horse. He is remarkable for spirit, liveliness, and draught qualities. He averages sixteen hands, head short, jaw heavy, neck short and thick, shoulder oblique, short back, quarters broad, chest deep and wide, legs short. It is a very obedient race, bearing great hardships and coarse fare. Mr. Harris, of New-Jersey, has imported a fine pair. The well-known and justly celebrated Canadian horse has all the qualities of the Norman, from which it is derived, except the size. This breed, although not so powerful, is much more valuable than the English, Dutch, or Flemish draught horse, for it is a good roadster, carriage, and wagon horse.

The Clydesdale (*Fig.* 4) is the best

Fig. 4.



English cart-horse, and has much of the qualities of the Norman. It is much lighter than the Suffolk punch; the chest is broad, shoulder thick and oblique, the back straight and broad. This horse is remarkably true and faithful, with great endurance. It is an admirable plough horse, and often sufficiently lively for the carriage.

The Conestoga horse of Pennsylvania is a good carriage and draught animal.

The heavy English cart and dray horse, although of great power, is not suited to our wants from his extreme slowness.

Among the different varieties of horse, there is nothing equal in beauty, liveliness, and docility to the Shetland pony, of eight and nine and a half hands high. They are frequently used to draw light carriages. The Welsh pony is occasionally a beautiful creature.

" *General Management of Horses.*—The foal, as soon as it is dropped, should be turned with its dam into a sheltered and good pasture, in which there is a hovel for occasional retreat from the wind and the rain. Some hay or corn, or both, should be allowed, if it is early in the season, or the grass has scarcely begun to shoot. There is nothing so detrimental to the colt as insufficient food. It should be regarded as a fundamental principle in breeding, that if the growth is checked by starvation, beauty, and energy, and stoutness will rarely be displayed in after years.

" In five or six months, according to the growth of the foal, or the convenience of the farmer, the weaning may take place. The colt should be removed from his former haunts to some distant rick-yard, or confined to a stable until he becomes a little reconciled to the loss of his dam.

" In the ensuing spring the *breaking* may commence; a process on which will materially depend the temper and the value of the horse, and the pleasure of the rider. The foal should be handled and haltered, and led about by the servant who has the chief care of him, and whose conduct towards him should always be kind. 'The principle,' says the author of 'The Horse,' 'on which the after usefulness of the animal is founded, is early attachment to and confidence in man, and obedience, resulting principally from these.'

" With regard to the racing colt, the processes of breaking and training are injuriously and cruelly completed in the second year, and thousands of horses are irreparably injured by this early exaction of labour and speed; but in the hunter, the hackney, the agricultural, and the carriage horse, the serious part of this business is not entered upon until the third year.

"A horse is well broken when he has been taught implicit and cheerful obedience to his rider or driver, and dexterity in the performance of his work. A dogged, sullen, spiritless submission may be enforced by the cruel and brutal usage to which the breaker so frequently has recourse; but that prompt and eager response to the slightest intimation of the rider's will; that manifest aim to anticipate every wish, that gives to the horse so much of his value, must be built on habitual confidence and attachment. The education of the horse should be that of a child. Pleasure should be, as much as possible, associated with the early lessons; while firmness, or, if need be, coercion, must establish the habit of obedience.

"The breaking being accomplished, the management of the horse will vary according to his breed and destination; but the good usage of our domesticated slaves should be regarded as a principle that ought never to be violated. The agricultural horse is seldom over-worked, and on large farms is generally well fed: perhaps, in many cases, too much above his work; this, however, is an error on the right side. A very slight inspection of the animal will always enable the owner to determine whether he is too well or not sufficiently fed. The size of the horse and the nature of the work, and the season of the year, will make considerable difference in the quantity and quality of the food. The following accounts will sufficiently elucidate the general custom: Mr. Harper ploughs seven acres per week, the year through, on strong land, with a team of three horses, and allows to each, weekly, two bushels of oats, with hay, during the winter six months, and during the remainder of the year one bushel of oats per week, with green food. Mr. Ellman allows two bushels of oats, with pease haulm or straw, with but very little hay, during thirty winter weeks. He gives one bushel of oats, with green food, during the summer. There is very little difference in the management of these two gentlemen, and that probably arising from circumstances peculiar to their respective farms. The grand principles of feeding, with reference to agricultural horses, are, to keep the animal rather above his work, to give him good and wholesome food, and, by the use of the nose-bag, or other means, never to let him be worked more than four or five hours without being baited.

"The horse of quick work, the stage-coach horse and the poster, should be allowed as much as he will eat, care being taken that no more is put into the manger than he will readily dispose of. The quantity actually eaten will depend on the degree of work and the natural appetite of the horse; but it may be averaged at about 66 pounds of cut straw, 17½ pounds of beans, and 77 of oats per week. When the work is unusually hard, the quantity of oats may be diminished, that of beans increased.

"During the sporting season the hunter is well fed, and with that kind of food which contains a great proportion of nutriment in little compass. A small quantity of hay, rarely more than eight or ten pounds per day, is allowed, and less than that on the day before work. The quantity of oats may vary from 14 to 16 pounds daily. There is a prejudice in most hunting stables, and probably well founded, against chaff, and it is seldom that the beans and oats are bruised. A bran-mash is given after a day of more than usual fatigue, and is serviceable at other times, when there has not been more than ordinary work, provided that at least two days are suffered to elapse before the horse is again taken into the field.

"No horse should be urged on after he has exhibited unequivocal symptoms of distress, such as a drooping pace, a staggering gait, a heavy bearing on the hand, a rapid inspiration like a hurried sigh, and a peculiar convulsive action of the diaphragm, as though the heart were violently beating against the side. The loss of blood, the administration of some cordial medicine, and slow leading to the nearest stable, are the best restoratives at the moment of distress; although the cordial would be absolutely destructive a few hours afterward, when inflammation had commenced.

"The hunting season having passed, the horse used to be turned into the field as soon as the grass had begun fairly to sprout, and there, with his feed or two feeds of corn daily, and his hovel, into which he might retreat from the sun or the storm, he remained until the middle of June, or the flies began to be troublesome. It was delightful to see how much he enjoyed this short period of liberty; and well had he earned it. Of late years, however, it has become the fashion to confine him to his box, whence he stirs not, except for an hour's walking exercise on the road, until he is taken into training for the next winter's business.

"Nothing can be so erroneous or cruel as this. There are few horses that have not materially suffered in their legs and feet before the close of the hunting season. There cannot be anything so refreshing to their feet as the damp coolness of the herbage which they tread at that period; and there is no physic which so safely and effectually as the spring grass carries off every humour that may be lurking in their frame.

"The training of the hunter for his work is a simple affair; it is, by means of exercise and physic, getting rid of all superfluous fat and flesh without debilitating him. The physic is useful; it is indispensable; but the chief thing is gradually to accustom him to the exertion of every power that he possesses, without too much hurrying his breathing or overstraining or injuring him.

"The training of the race-horse is of a similar character, but it is far more severe, for his strength, his speed, and his endurance must be tested to the utmost. The hunter has to carry his rider gallantly and well through perhaps a long burst, and if he tires, and the sportsman has the good sense and humanity to cease to urge him on, the greatest evil is some temporary suffering to him, and disappointment to his master; but if the race-horse breaks down, or if his capabilities have not been accurately calculated, the most serious loss may be sustained. Thence arises the necessity of straining and of testing every power in the preparation of the turf horse; and thence, too, it happens, from the strange and impolitic sacrifice of the endurance of the modern racer to speed during short distances, that so many young horses break down and become perfectly useless in their training.

"The *watering* of the horse is a very important but disregarded portion of his general management. The kind of water has not been sufficiently considered. The difference between what is termed *hard* and *soft* water is a circumstance of general observation. The former contains certain saline principles which decompose some bodies, as in the curdling of soap; and prevent the solution of others, as in the making of tea, the boiling of vegetables, and the process of brewing. It is natural to suppose that these different kinds of water would produce somewhat different effects on the animal frame, and such is the fact. Hard water, freshly drawn from the well, will frequently roughen the coat of the horse unaccustomed to it, or cause griping pains, or materially lessen the animal's power of exertion. The racing and the hunting groom are perfectly aware of this, and so is the horse, for he will refuse the purest water from the well if he can obtain access to the running stream, or even the turbid pool. Where there is the power of choice, the soft water should undoubtedly be preferred.

"The temperature of the water is of far more consequence than its hardness. It will rarely harm if taken from the pond or the running stream, but its coldness, when recently drawn from the well, has often been injurious. It has produced colic, spasm, and even death. It should, therefore, be exposed for some hours, either in the stable or in some tank.

"There is often considerable prejudice against the horse being fairly supplied with water. It is supposed to chill him, to injure his wind, or to incapacitate him for hard work. It certainly would do so if, immediately after drinking his fill, he were galloped hard, but not if he were suffered to quench his thirst more frequently when at rest in the stable. The horse that has free access to water will not drink so much in the course of a day as another who, to cool his parched mouth, swallows as fast as he can, and knows not when to stop.

"When on a journey, a horse may, with perfect safety, be far more liberally supplied with water than he generally is. An hour before his work commences he should be permitted to drink a couple of quarts. A greater quantity might be probably objected to. He will perform his task far more pleasantly and effectively than with a parched mouth and tormenting thirst. The prejudice both of the hunting and the training groom, on this point, is cruel as well as injurious. The task or the journey being accomplished, and the horse having breathed a few minutes, another quart, or even two, will be delightfully refreshing to him, and will never do him harm. His corn may then be offered to him, which he will readily take ; and, before he has eaten the whole of it, two or three more quarts of water may be given.

"Towards the close of the day, the speed of the traveller should somewhat abate, and the horse should arrive at his resting-place as dry and as cool as circumstances will permit. If he is hot, he must be walked about a while, or the perspiration will return in the stable. If he is wet, he must be carefully rubbed dry. The sooner this is done the better; and, after he is clothed, watered, fed, and bedded, he should, as soon as possible, be left to his repose. Professor Stewart, of Glasgow, has lately published a very useful work on the 'Stable Economy, or General Management of Horses.' We abridge his account of 'the kinds of work, and the preparation for them.'

"*Travelling.* — The horse should undergo some degree of training as to the pace, the distance, and the burden. When there has been no preparation, the stages must at first be short, and the pace gentle. For a journey of 300 miles the horse may travel from twenty to twenty-five miles a day, resting on the Sunday, and doing the work in two stages, at the pace of six miles an hour. This requires a seasoned horse, and the number of working hours per day is about four.

"*Hunting* requires speed and stoutness. The pace seldom exceeds twelve miles an hour, and the run is short, soon over, or interrupted ; yet soft, sinking ground, hills, and leaps make this pace severe even on the best horses. The time for preparation varies from two to four months. On the day before work, the horse should have exercise enough to empty the bowels. If he is a good feeder, he should have no hay within eight hours of starting, nor water within four hours, nor corn within three hours ; but if he has five or six miles to go to cover, these restrictions are less necessary. The working days will vary according to his condition and the hardness of the running. He may be able to go out every second day, and sometimes not more than once in six or seven. His spirits and appetite, and the state of his legs, will decide this. Even on the blank days some exercise should be taken in order to evacuate the bowels and create an appetite.

"*Coaching.*—The horses are best prepared for their work by good feeding and gradual increase of speed and distance. The ordinary length of a stage is eight to fourteen miles ; the pace being calculated at from eight to eleven miles an hour. The muscular exertion is severe while it lasts, but it is soon over. The excitement, however, of high keep and excessive exertion gradually wears the horse down, and it is rarely that he continues in a fast coach more than six years.

"*Carting.* — Cart-horses usually work from eight to ten hours, six days in the week. The pace varies from two miles to three and a half per hour, and the weight rarely exceeds twenty-four cwt., besides the cart, which probably is seven or eight more. All beyond this in weight or in time of work is cruel.

"*Ploughing.*—The average work is about eight hours in the day. The severity of it depends on the pace, the nature of the soil, and the breadth of the furrow-slice. The pace is from two miles to two and a half per hour; the horse and the man can well support this as long as the ploughing season continues.

"*Diseases of Horses* (from Youatt). —It may be readily supposed that the animal doomed to the manner of living just traced in every variety of the horse, will be peculiarly exposed to numerous forms of suffering. Every natural evil will be aggravated, and many new and formidable sources of pain and death will be superadded.

"Interest and humanity require that we should become acquainted with the nature, and causes, and remedy of the diseases of the horse. Only a slight sketch of them can be given here, but sufficient, perhaps, to enable the owner to recognise their existence, to avoid their causes, or to induce him to apply to the proper quarter for their removal or alleviation.

"The principal diseases of the horse are connected with the circulatory system. From the state of habitual excitement in which the animal is kept, in order to enable him to execute his task, the heart and the blood-vessels will often act too impetuously. The vital fluid will be hurried along too rapidly, either through the frame generally, or some particular part of it, and there will be *congestion*, accumulation of blood in that part, or there will be *inflammation*, either local or general, disturbing the functions of some organ or of the whole frame.

"*Congestion.*—Take a young horse on his first entrance into the stables; feed him somewhat highly, and what is the consequence? He has swellings of the legs, or inflammation of the joints, or perhaps of the lungs. Take a horse that has lived somewhat above his work, and gallop him to the top of his speed: his nervous system becomes highly excited; the heart beats with fearful rapidity; the blood is pumped into the lungs faster than they can discharge it; the pulmonary vessels become gorged, fatigued, and utterly powerless; the blood, arrested in its course, becomes viscid, and death speedily ensues. We have but one chance of saving our patient, viz., the instantaneous and copious extraction of blood; and one means of preventing the recurrence of this dangerous state, namely, by not suffering too great an accumulation of the sanguineous fluid by over-feeding, and, by regular and systematic exercise, inuring the circulatory vessels to prompt and efficient action when they are suddenly called upon to exert themselves. The cause and the remedy are sufficiently plain.

"Again, the brain has functions of the most important nature to discharge, and more blood flows through it than any other portion of the frame of equal bulk. In order to prevent this organ from being oppressed by a too great determination of blood to it, the vessels, although numerous, are small, and pursue a very circuitous and winding course. A horse highly fed, and full of blood, is suddenly and sharply exercised: the course of the blood is accelerated in every direction, and to the brain among other parts. The vessels that ramify on its surface or penetrate its substance are completely distended and gorged with it. Perhaps they are ruptured, and the effused blood presses upon the brain; it presses upon the origins of the nerves, on which all sensation and motion depend, and the animal suddenly drops powerless. A prompt and copious abstraction of blood, or, in other words, a diminution of this pressure, can alone save the patient. Here is the nature, the cause, and the treatment of *apoplexy.*

"Sometimes this disease assumes a different form. The horse has not been performing more than his ordinary work, or perhaps he may not have been out of the stable. He is found with his head drooping and his vision impaired. He is staggering about; he falls, and lies half unconscious, or he struggles violently and dangerously. There is the same congestion of blood in the head, the same pressure on the nervous origins, but produced by a different cause. He has been accustomed habitually to overload his stomach, or he was on the previous day kept too long from his food, and then he fell ravenously upon it, and ate until his stomach was completely distended and unable to propel forward its accumulated contents. Thus distended, its blood-vessels are compressed, and the circulation through them is impeded or altogether suspended. The blood is still forced on by the heart, and driven in accumulated quantity to other organs, and to the brain among the rest; and there congestion takes place, as just described, and the animal becomes sleepy, unconscious, and, if he is not speedily relieved, he dies. This, too, is apoplexy; the horseman calls it *stomach staggers.* Its cause is improper feeding. The division of the hours of labour, and the introduction of the *nose-bag*, have much diminished the frequency of its occurrence. The remedies are plain: bleeding, physicking, and the removal of the contents of the stomach by means of a pump contrived for that purpose.

"Congestions of other kinds occasionally present themselves. It is no uncommon thing for the blood to loiter in the complicated vessels of the *liver*, until the membrane of that viscus has burst, and an accumulation of congealed black blood has presented itself. It is the same with the *spleen.* It constitutes the *swelled legs* to which so many horses are subject when they stand too long idle in the stable. Congestion is the source of many of the accumulations of serous fluid in various parts of the body, and particularly in the chest, the abdomen, and the brain.

"*Inflammation* is opposed to *congestion*, as consisting in an active state of the capillary arterial vessels; the blood rushing through them with far greater rapidity than in health, from the excited state of the nervous system, by which they are supplied.

"Inflammation is either *local* or *diffused.* It is confined to one organ, or to a particular portion of that organ; or it involves many neighbouring ones, or it is spread over the whole frame. In the latter case it assumes the name of *fever.* Fever is general or constitutional inflammation, and is said to be *sympathetic* or *symptomatic* when it can be traced to some local affection or cause, and *idiopathic* when we cannot so trace it. The truth probably is that every fever has its local cause, but we have not a sufficient knowledge of the animal economy to be able to discover it.

"Inflammation may be considered with reference to the membranes which it attacks.

"The *mucous membranes* line all the cavities that communicate with the external surface of the body. There is frequent inflammation of the membrane of the mouth. *Blain*, or *Glossanthrax*, is a vesicular enlargement which runs along the side of the tongue. Its cause is unknown. It should be lanced freely and deeply, and a little aperient medicine administered. *Barbs*, or *paps*, are smaller enlargements, found more in the neighbourhood of the bridle of the tongue. They should never be touched with any instrument: a little cooling medicine will generally remove them. *Lampas* is inflammation of the palate, or enlargement of the bars of the palate. The roof of the mouth may be slightly lanced, or a little aperient medicine administered; but the sensibility of the mouth should never be destroyed by the application of the heated iron. *Canker* and *wounds in the mouth*, from various causes, will be best remedied by diluted tincture of myrrh, or a weak solution of alum. *Foreign bodies in the gullet* may generally be removed by means of the probang used in the hoove of cattle: or the œsophagus may be opened, and the obstructing body taken out. It is on the mucous membranes that *poisons* principally exert their influence. The *yew* is the most frequent vegetable poison. The horse may be saved by timely recourse to equal parts of vinegar and water injected into the stomach, after the poison has been, as much as possible, removed by means of the stomach-pump. For arsenic, hydrated peroxide of iron; corrosive sublimate, white of eggs. *Spasmodic colic* is too frequently produced by exposure to cold, or the drinking of cold water, or the use of too much green meat. The horse should be walked about; strong friction used over the belly, and spirit of turpentine given in doses of two ounces, with an ounce each of laudanum and spirit of nitrous æther, in warm water or ale. If the spasm is not soon relieved, the animal should be bled, an aloetic ball administered, and injections of warm water with a solution of aloes thrown up. This spasmodic action of the bowels, when long continued, is liable to produce *introsusception*, or *entanglement*, of them, and the case is then hopeless. *Superpurgation* often follows the administration of a too strong or improper dose of physic. The torture which it produces will be evident by the agonized expression of the countenance, and the frequent looking at the flanks. Plenty of thin starch or arrow-root should be given both by the mouth and by injection; and twelve hours having passed without relief being experienced, chalk, catechu, and opium should be added to the gruel. *Worms* in the intestines are not often productive of much mischief, except they exist in very great quantities. Small doses (two drachms) of emetic tartar, with a little ginger, may be given to the horse half an hour before his first meal, in order to expel the round white worm; and injections of linseed oil or aloes will remove the ascarides, or needle-worms.

"The *respiratory passages* are all lined by the mucous membrane. *Catarrh*, or *cold*, inflammations of the upper air passages, should never be long neglected. A few mashes or a little medicine will usually remove it. If it is neglected, and, occasionally, in defiance of all treatment, it will degenerate into other diseases. The larynx may become the principal seat of inflammation. *Laryngitis* will be shown by extreme difficulty of breathing, accompanied by a strange, roaring noise, and an evident enlargement and great tenderness of the larynx when felt externally. The windpipe must be opened in such case, and the best advice will be necessary. Sometimes the subdivisions of the trachea, before or when it first enters the lungs, will be the part affected, and we have *bronchitis*. This is characterized by a quick and hard breathing, and a peculiar wheezing sound, with the coughing up of mucus. Here, too, decisive measures must be adopted, and a skilful practitioner employed. So should he in *distemper*, *influenza*, and *epidemic catarrh*, names indicating the same disease, and produced by atmospheric influence, varying to a certain degree in every season, but in all characterized by intense inflammation of the mucous surfaces, and by rapid and utter prostration of strength, and in all demanding the abatement of that inflammation, and yet no expenditure of vital power.

"Cough may degenerate into *inflammations of the lungs*; or this fearful malady may be developed without a single premonitory symptom, and may prove fatal in twenty-four, or even in twelve hours. It is mostly characterized by deadly coldness of the extremities, expansion of the nostril, redness of its lining membrane, singularly anxious countenance, constant gazing at the flank, and an unwillingness to move. A successful treatment of such a case can be founded only on the most prompt, and fearless, and decisive measures. The lancet must be freely used; counter-irritants must follow as soon as the violence of the disease is in the slightest degree abated; sedatives must succeed to them, and fortunate will he be who often saves his patient after all the decisive symptoms of pneumonia are once developed.

"Among the consequences of these severe affections of the lungs are *chronic cough*, not always much interfering with the usefulness of the horse, but strangely aggravated at times by any fresh accession of catarrh, and too often degenerating into *thick wind*, which always materially interferes with the speed of the horse, and in a great proportion of cases terminates in broken wind. It is rare, indeed, that either of these diseases admits of cure, nor does that obstruction in some part of the respiratory canal, and varying in almost every horse, which produces the peculiar sound termed *roaring*.

"*Glanders*, the most destructive of all the diseases to which the horse is exposed, is the consequence of breathing the atmosphere of foul and vitiated stables—the winding up of almost every other disease, and in every stage of it most contagious. Its most prominent symptoms are a small but constant discharge of sticky matter from the nose, an enlargement and induration of the glands beneath and within the lower jaw, on one or both sides; and, before the termination of the disease, cancerous inflammation of the nostril on the same side with the enlarged gland. Its contagiousness should never be forgotten, for if a glandered horse is once introduced into a stable, almost every horse in it will sooner or later become infected and die.

"The urinary and genital organs are also lined by mucous membranes. The horse is subject to *inflammation of the kidneys* from eating musty oats or mow-burned hay, from exposure to cold, and from injuries of the loins. Bleeding, physic, and counter-irritants over the region of the loins should be had recourse to. *Diabetes*, or *profuse staling*, is difficult to treat. The inflammation that may exist should first be subdued; and then opium, catechu, and the uva ursi administered. *Inflammation of the bladder* will be best alleviated by mucilaginous drinks of almost any kind. *Inflammation of the neck of the bladder*, evinced by the frequent and painful discharge of small quantities of urine, will yield only to the abstraction of blood and the exhibition of opium. A catheter may be easily passed into the bladder of the mare and the urine evacuated; but it will require a skilful veterinary surgeon to effect this in the horse. *A stone in the bladder* is readily detected by the practitioner, and may be extracted with comparative ease. The sheath of the penis often becomes diseased from the presence of corrosive mucous matter: it may easily be removed with warm water and soap.

"To the mucous membranes belong the conjunctival tunic of the eye, and the diseases of the eye generally may be here considered. A *scabby itchiness* on the edge of the eyelid may be got rid of by a diluted nitrated ointment of mercury. *Warts* should be cut off with the scissors, and the roots touched with lunar caustic. *Inflammation of the haw* should be abated by the employment of cooling lotions, but that useful defence of the eye should never, if possible, be removed. Common *ophthalmia* will yield as readily to cooling applications as inflammation of the same organ in any other animal; but there is another kind of inflammation, commencing in the same way as the first, and for a while apparently yielding to treatment, but which changes from eye to eye, and returns again and again, until blindness is produced in one or both organs of vision. The most frequent cause is hereditary predisposition. The reader cannot be too often reminded that the qualities of the sire, good or bad, descend, and scarcely changed, to his offspring. How *moon-blindness* was first produced, no one knows; but its continuance in our stables is to be traced to this cause principally, or almost alone, and it pursues its course until cataract is produced, for which there is no remedy. *Gutta serena* (palsy of the optic nerve) is sometimes observed, and many have been deceived, for the eye retains its perfect transparency. Here, also, medical treatment is of no avail.

"The serous membranes are of great importance. The brain and spinal marrow, with the origins of the nerves, are surrounded by them; so are the heart, the lungs, the exterior coat of the intestinal canal, and the testes.

"*Inflammation of the Brain.*—Mad staggers falls under this division; it is inflammation of the meninges, or envelopes of the brain, produced by over-exertion, or by any of the causes of general fever, and it is characterized by the wildest delirium. Nothing but the most profuse blood-letting, active purgation, and blistering the head, will afford the slightest hope of success. *Tetanus*, or *Locked Jaw*, is a constant spasm of all the voluntary muscles, and particularly those of the neck, the spine, and the head, arising from the injury of some nervous fibril—that injury spreading to the origin of the nerve—the brain becoming affected, and universal and unbroken spasmodic action being the result. Bleeding, physicking, blistering the course of the spine, and the administration of opium in enormous doses, will alone give any chance of cure. *Epilepsy* is not a frequent disease in the horse, but it seldom admits of cure. It is also very apt to return at the most distant and uncertain intervals. *Palsy* is the suspension of nervous power; it is usually confined to the hinder limbs, and sometimes to one limb only. Here bleeding and physicking, and antimonial medicines, and blistering of the spine, are the most rational applications, but they too often utterly fail of success. *Rabies*, or madness, is evidently a disease of the nervous system, and once being developed, is altogether without cure. The utter destruction of the bitten part with the lunar caustic, soon after the infliction of the wound, will, however, in a great majority of cases, prevent the development of the disease.

"*Pleurisy*, or inflammation of the serous covering of the lungs and the lining of the cavity of the chest, is generally connected with inflammation of the substance of the lungs; but it occasionally exists independent of any state of the lungs. The pulse is in this case hard and full, instead of being oppressed; the extremities are not so intensely cold as in pneumonia, the membrane of the nose is little reddened, and the sides are tender. It may be of importance to distinguish between the two, because in pleurisy more active purgation may be pursued, and the effect of counter-irritants will be greater, from their proximity to the seat of disease. Copious bleedings and sedatives here also should be had recourse to. It is in connexion with pleurisy that a serous fluid is effused in the chest, the existence and the extent of which may be ascertained by the practised ear, and which in many cases may be safely evacuated.

"The heart is surrounded by a serous membrane, the pericardium, that secretes a fluid, the interposition of which prevents any injurious friction or concussion in the constant action of this organ. If this friction increases to too great a degree, the action of the heart may be impeded or destroyed; this is *dropsy of the heart;* it is difficult to detect, and more difficult to cure. The heart itself is often diseased; it sympathizes with the inflammatory affection of every organ, and therefore is itself occasionally inflamed. *Carditis*, or *inflammation of the heart*, is characterized by the strength of its pulsations, the tremour of which can be seen, while the sound can be heard at a distance of several yards. Speedy and copious blood-letting will afford the only hope of cure in such a case.

"The outer coat of the stomach and intestines is composed of a serous membrane, the peritoneum, which adds strength and firmness to their textures; attaches, and supports, and confines them in their respective places, and secretes a fluid that prevents all injurious friction between them. This coat is exceedingly subject to inflammation, somewhat gradual in its approach; the pulse quickened, but small; the legs cold; the belly tender; there being constant pain, and every motion increasing it; there also being rapid and great prostration of strength. These symptoms will sufficiently characterize *peritoneal inflammation*. Bleeding, aperient injections, and extensive counter-irritation will afford the only hope of cure.

"The time for *castration* varies according to the breed and destiny of the horse. On the farmer's colt it may be effected when the animal is not more than four or five months old, and it is comparatively seldom that a fatal case then occurs. For other horses much depends on their growth, and particularly on the development of their fore quarters. Little improvement has been effected in the old mode of castrating, except the opening of the scrotum, and the division of the cord by the knife instead of the heated iron.

"*Synovial*, or *joint membranes*, are interposed between the divisions of the bones, and frequently between the tendons, in order to secrete a certain fluid that shall facilitate motion and obviate friction. Occasionally the membrane is lacerated, and the synovia escapes. This is termed *opened joint*, and violent inflammation rapidly ensues. The duty of the practitioner is to close this opening, and as quickly as possible. Nothing is so effectual here as the old application of the cautery. A great deal of inflammation and engorgement is produced around the opening, partially, if not altogether, closing it, or, at least, enabling the coagulated synovia to occupy and obliterate it. Perhaps, in order to ensure the desired result, the whole of the joint should be blistered; a bandage should then be firmly applied, and kept on as long as possible. If, after this, there is any escape of the synovia, the cautery must again be had recourse to.

"*The Navicular Disease* is a bruise, or inflammation, or perhaps destruction, of the cartilage of the navicular bone, where the flex or tendon of the foot passes over it in order to reach the coffin bone. The veterinary surgeon can alone ascertain the existence and proper treatment of this disease. *Spavin* is an enlargement of the inner side of the hock. The splent bones, which support the inferior layer of those of the hock, sustaining a very unequal degree of concussion and weight, the cartilaginous substance which unites them to the shank bone takes on inflammation, it becomes bony instead of cartilaginous, and the disposition to this change being set up in the part, bony matter continues to be deposited, until a very considerable enlargement takes place, known by the name of *spavin*, and there is considerable lameness in the hock joint. The bony tumour is blistered, and probably fired, but there is no diminution of the lameness until the parts have adapted themselves, after a considerable process of time, to the altered duty required of them, and then the lameness materially diminishes, and the horse becomes, to a very considerable extent, useful. *Curb* is an enlargement of the back of the hock, three or four inches below its point. It is a strain of the ligament which there binds the tendons down in their place. The patient should be subjected to almost absolute rest; a blister should be applied over the back of the tumour, and, occasionally, firing will be requisite to complete the cure. Near the fetlock, and where the tendons are exposed to injury from pressure or friction, little bags or sacs are placed, from which a lubricating mucous fluid constantly escapes. In the violent tasks which the horse occasionally has to perform, these become bruised and inflamed, and enlarged and hardened, and are termed *wind-galls*; they blemish the horse, but are no cause of lameness after the inflammation has subsided, unless they become very much enlarged. The cautery will then be the best cure. Immediately above the hock, enlargements of a similar nature are sometimes found, and, as they project both inwardly and outwardly, they are termed *thorough pins*. They are seldom a cause of lameness, but they indicate great, and perhaps injurious exertion of the joint. On the inside of the hock a tumour of this kind, but of a more serious nature, is found. It is one of these enlarged mucous bags, but very deeply seated, the subcutaneous vein of the hock passing over it. The course of the blood through the vein is thus, in some measure, arrested, and a portion of the vessel becomes distended. This is a serious evil; for, from the deep-seatedness of the mucous bag, it is almost impossible to act effectually upon it. It is termed *bog* or *blood spavin.*

"The cellular tissue which fills the interstices of the various organs, or enters into their texture, is the seat of many diseases. From the badness of the harness, or the brutality of the attendant, the poll of the horse becomes contused. Inflammation is set up, considerable swelling ensues, and an ulcerative process soon commences, and chasms and sinuses of the most frightful extent begin to appear. The withers are probably bruised, and the same process takes place there, and sinuses penetrate deep beneath the shoulder, and the bones of the withers are frequently exposed. These abscesses are termed *poll evil* and *fistulous withers*, and in the treatment of them the horse is often tortured to a dreadful and disgraceful extent. A better mode of management has, however, been introduced: setons are passed through the most dependant parts; no collection of sanious fluid is permitted to exist, and milder stimulants are applied to the surface of the ulcer.

"An abscess of a peculiar character is found between the branches of the lower jaw in young horses; it is preceded by some degree of fever. It is usually slow in its progress, but at length it attains a considerable size, including the whole of the cellular tissue in that neighbourhood. There is one uniform mass of tumefaction. This is *strangles. Vives* appears to be the first stage of this disease. It seems to be an effort of nature to get rid of something which oppresses the constitution, and the treatment of it is now simple and effectual. It is encouraged by fomentations and by blisters: it is punctured as soon as the fluctuation of a fluid within it can be fairly detected, the pus speedily escapes, and there is an end of the matter.

"To one disease of the absorbent system a brief reference must be made.

"*Farcy.*—While the arterial capillaries are engaged in building up the frame, the absorbents are employed in removing that which not only is useless, but which would be poisonous and destructive. They take up the matter of glanders and of every ulcerating surface, and they are occasionally irritated, inflamed, and ulcerated, from the acrimonious nature of the poison which they carry. The absorbents are furnished with numerous valves; the fluid is, for a while, arrested by them, and there the inflammation is greatest, and ulceration takes place. This is the history of the farcy cords and buds. Farcy is a highly contagious disease, whether or not it be connected with glanders. It, however, occasionally admits of cure from the application of the cautery to the bud, and the administration of very small doses of corrosive sublimate, or the sulphate of iron, internally.

"The skin of the horse is subject to various diseases. Large pimples, or lumps, suddenly appear on the skin, and, after remaining a few days, the cuticle peels off, and a circular scaly spot is left: this is called *surfeit.* The cause is obscure, but principally referable to indigestion. A slight bleeding will always be serviceable; physic rarely does good; but alteratives, composed of nitre, black antimony, and sulphur, will be very beneficial. *Mange* is a disease of a different character. It is the curse of the stable into which it enters, for it will almost certainly affect every horse. Thorough dressings with Barbadoes tar and linseed oil, in the proportion of one of the former to three of the latter, will be the most effectual external application, while alteratives and physic should be given internally. *Hide-bound* is a very appropriate term for the peculiar sticking of the hide to the ribs when a horse is out of condition. The subcutaneous adipose matter is all absorbed. The alterative above recommended will be very useful here. *Grease* is an undue secretion of the fluid which was designed to lubricate the skin of the heels, and that secretion being also altered in quality. The hind legs begin to swell, a fluid exudes from the heels, the hairs of the heels become erect like so many bristles, and the skin of the heel is hot and greasy. Soon afterward cracks appear across the heel, they discharge a thick and offensive matter, and then deepen. They spread up the leg, and so does the tumefaction of the part. In process of time the skin, inflamed and ulcerated, undergoes an alteration of structure; prominences or granulations appear on it, assuming the appearance of a collection of grapes, or the skin of a pineapple. They increase, and a fœtid discharge appears from the crevices between them.

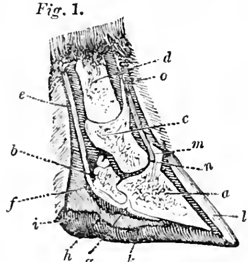
"The cause is generally neglect of the horse. He is suffered to stand in the stable with his heels cold and wet, and this must necessarily dispose them to inflammation and disease.

"In the first stage of grease, bran, or turnip, or carrot poultices will be serviceable, with moderate physic. Then astringents must be employed, and the best are alum or sulphate of copper in powder, mixed with eight times the quantity of Bole Armenian, and sprinkled on the sores. These should be alternated every three or four days. The grapy heels are a disgrace to the stable in which they are found, and admit not of radical cure."

Wounds in horses seldom heal by first intention; the lips should, however, be brought together nicely and bound by sticking plaster or a bandage; if suppuration occurs, keep the wound clean by warm water. For the medicines, see *Pharmacopœia*.

HORSE'S FOOT. The structure of the feet of horses is much more complex than one might suppose at first sight; it is contrived so as to furnish an arrangement of springs, whereby the weight of the body in alighting on the hoof is broken, and the animal is enabled to leap from the ground with facility. This structure will be seen in *Fig.* 1, which

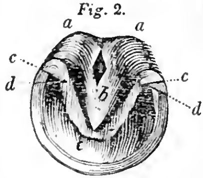
Fig. 1.



represents a section of the lower part of the leg. *a* is the coffin bone; *b* the navicular, or nut bone; *c* the coronary, or little pastern bone; *d* is the pastern bone; *e* the tendon, or sinew, of the muscle which bends the foot backward; *f* is the same tendon sliding over the navicular bone, and *g* its insertion in the bottom of the coffin bone; *h* the elastic matter of the sensible frog; *i* the insensible or horny frog; *k* the horny sole covering the sensible parts of the foot; *l* the front horn that protects the coffin bone; *m* the process of the coffin bone, to which the extensor tendon, *n*, is attached, for the purpose of throwing the foot forward; *o* the attachment of the extensor to the coronary bone, to assist in making the spring. From this it will be seen that when a horse is alighting his whole weight is not expended upon an unyielding and hard hoof, but upon a series of bones which participate and divide the shock, reducing it to a trifling pressure on each part. It is this complexity of arrangements which renders the horse's foot so liable to injuries: when any of the ligamentous connexions or synovial membranes between the bones is irritated it produces lameness, which, if not speedily attended to, may become permanent.

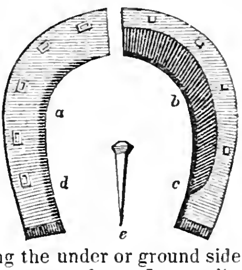
The hoof, or horn, of the foot on the under side is marked by certain projections, which are altered in their form in disease. *Fig.* 2 represents

Fig. 2.



a healthy sole: the rounded portions of the hoof, *a*, *a*, behind where the nail is curved inward, are called the heels; between these lies the horny frog, *b*; the inflected or bent portions of the hoof, *c*, *c*, running on the outside the frog, are called the bars; *d d* are the angles of the bars, in which corns occur in diseased feet; in the latter case the frog becomes contracted, and often fissured, producing pus (*thrush*); the bars are run together, and the heels, instead of being rounded and wide apart, are contracted to a mere slit. The space, *e*, lying between the front edge of the hoof and the bars in the sole should be broad and concave. When this external covering is removed from the foot, it is found to rest on the sensible sole and frog, both of which, and especially the latter, are highly vascular and sensitive; they are, indeed, to the hoof what the quick is to the human nail, they secrete the tough horn to protect themselves. In disease it sometimes occurs that the sensible frog refuses to secrete horn, and produces pus and ulcers in its place; this is a result of foul stables. But the whole insensible sole may become painful and sensitive from bad shoeing, if the shoe fits ill, compresses any part, or during the growth of the nail becomes buried in it.

HORSESHOE. The best veterinary surgeons are unanimous in condemning the common horseshoe, from its want of width or web, from being usually too wide behind, from the calkins, or turned-up parts at the heels, and from the clinches being driven in too far back towards the heels, as well as the want of level and irregular figure. According to the practice of Moorcroft and others, the seated shoe of Osmer is the proper form. It is shown in the figure,



a being the under or ground side, and *b* the upper surface. Its peculiarities are, 1st, a flat, wide surface towards the ground, *a*, *d*; this is made true in forging by gauging on a flat iron; there is no groove or fullering, which only assists the wear; it is punched with conical holes with square tops, and clinched to the crust by conical nails, *e*; the nails are obliquely driven outward, and their figure keeps the shoe fast as long as any portion of them remains in place. The upper surface, *b*, *c*, is bevelled in the fore part and sides, but not behind, so as to offer a good support to the heel; there is no increase of thickness, clubbing, or calkings, but the whole shoe is uniformly thick, from one half to five eighths of an inch, and perfectly level. This is regarded by Loudon as a perfect shoe.

Calkings may be made where the

ground is slippery and much up hill; and a turn-up in front is also useful in rocky places. There is a shoe called the bar shoe, which is of an oval figure, the iron being complete around the heel, curved and thickened to suit it; but it is seldom used: it answers well to protect a tender frog. In putting on the shoe, all the crust trimmed should be taken quite level, and the shoe never put on hot to make it fit better; it may be gauged while hot for a minute to enable the smith to cut the crust true, but not clinched while hot. Racing shoes are very light, and of the figure above.

HORSE-CHESTNUT. *Æsculus hippocastanum.* This tree is remarkable chiefly for the beauty of its figure, flowers, and early foliage. The wood is soft and of little value. The nuts contain much nutritious matter, which is combined with a disagreeable bitter; but it is said that pigs eat them when pounded into meal. A writer in the American Farmer says that they are very saponaceous, and will take spots out of linen. The *Buckeyes* are of this genus, or, at least, of the sub-genus *Paria.*

HORSE DUNG. See *Farm-yard Manure.*

HORSE-FLY. *Hippobosca*, which see.

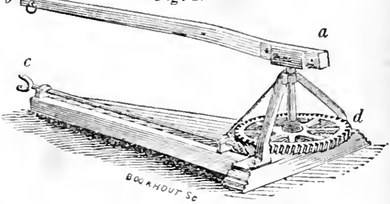
HORSE-HOE. See *Cultivator.*

HORSE POWER. In physics, the effect produced by the strength of a horse. James Watt allowed in his engine an effect equal to 32,000 pounds lifted one foot in a minute; but from experiments with horses, D'Aubuisson found it was only equal to 16,440 pounds raised one foot in a minute.

In *agricultural machines*, a horse power is a contrivance or gearing to make the labour of horses available in turning thrashing and other machines, where great swiftness is wanted.

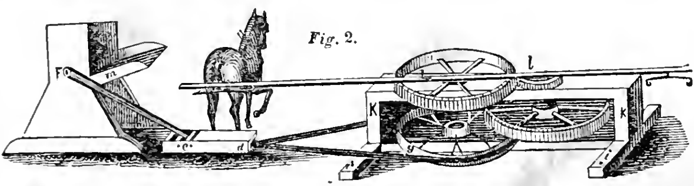
The simplest horse power (*Fig.* 1)

Fig. 1.



is a triangular wooden frame bearing a wheel, the upper axis of which is inserted into the lever, *a*; the horse is hitched at *b*, and, as he walks in a circle, turns the wheel, *d*, which plays into an endless screw, the end or rod of which, *c*, is made to revolve rapidly, and may be put in communication with a machine by the hook or by a small roller. The same arrangement, with several additional wheels to multiply motion, and a crown wheel instead of the endless screw, forms *Warren's horse power* (*Figure* 2), as well as other kinds.

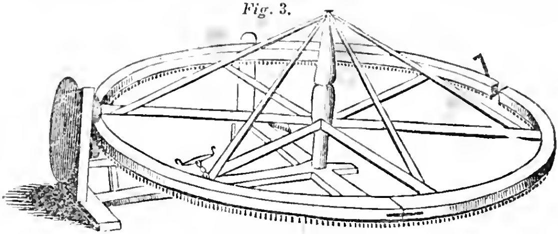
Fig. 2.



The old power for thrashing consisted of an upright beam, carrying at the top a crown or bevelled wheel of large circumference, and turning a small wheel, which was directly in contact with the thrasher or grinding mill. The horses were attached to levers, projecting from the central beam, and below the wheel. This is a simple and very efficient contrivance. A modification is introduced by Mr. Scripture, who puts no cogs to the wheel, but causes it to turn a roller by friction.

Taplin's horse power (*Fig.* 3) is a large wheel revolving on a short axis near to the ground. The driver sits on the top of the axis, and the horses work within the circumference, being hitched to it. The under side of the wheel carries iron teeth, which play upon a small wheel con-

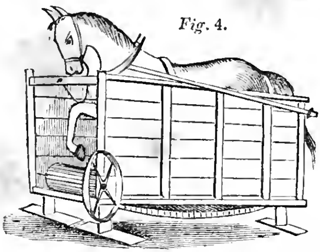
Fig. 3.



nected by a drum with the thrasher. It is readily carried, and set up on the field in a few minutes.

Gleason's horse power (*Fig.* 4) is on

Fig. 4.



another principle: an endless chain, carrying oaken slats for the horse to tread on, is made to turn a wheel, which carries a drum on the outside of the frame, from which a leather band communicates with the thrasher or mill. The horse or mule works within a framing to hinder accidents. Pitt's machine is of this class.

A very similar contrivance is used for dogs, the machine being reduced to a proper size. In this way churning and other light operations may be conducted.

These horse powers contain the three principles on which all the rest are constructed. The prices of the powers are from \$60 to \$90 for the single horse, and \$100 to \$120 for two or more horses.

HORSERADISH. *Cochlearia armoracia.* A cruciferous plant, with a perennial root, used as a condiment for its hot taste, resembling mustard.

The plants are obtained from cuttings, or offsets, from the crown of the preceding roots, each cutting having two eyes: they are set early in spring, in a deep, mellow earth that has been trenched. The soil should be moist and well manured. The sets may be placed in drills, eighteen inches to two feet apart, by six inches in the row, and during the first year beets or other plants can be raised in the drill intervals. Weeding and hoeing are necessary. The roots will be fit to be taken up in October and November of the second year, when they may be kept for use in sand. In taking up the roots the earth must be thoroughly loosened to obtain the whole, as they are frequently two feet deep. Offsets and broken pieces containing eyes will vegetate the next year, and in this way a bed once established may, by manuring, be kept up for a long period; but the best way is to select cuttings for a new bed the next year.

HORSE-RAKE. See *Hay-making*.

HORSE-TAIL. The genera *Equisetum*, or scouring rush, and *Hippuris*, remarkable for the large amount of silica they contain. They grow in rich, wet places, and some varieties are of value in the arts for polishing metals.

HORTICULTURE (from *hortus*, *a garden*, and *colo*, *I cultivate*). The cultivation of gardens and orchards. See *Garden Husbandry*.

HORTUS SICCUS. An herbarium, a collection of dried plants.

HOT-BED. See *Frame*.

HOT-HOUSE. A glazed structure, sufficiently high to allow persons to enter, and with conveniences for the production of artificial heat. The means of heating are various: some depend upon dung pits constantly renewed, others upon flues running in the walls, and conveying the hot air of a furnace. Steam is also conveyed by iron and copper pipes, and made to circulate several times through the house, especially under the beds. Hot water is also conveyed from a boiler round the house and back, so as to maintain a constant circulation, the boiler being provided with a safety-valve. The direct introduction of steam from a boiler through an open pipe is occasionally used as an economical way of heating the house when the plants are adapted to a very moist air.

The arrangements of the hot-house are various, according to the object in view. The roof usually sustains grapes; the highest wall, figs, apricots, early peaches, nectarines, and choice fruits: in the centre is arranged a rising frame containing the exotics, which require heat during winter, or the ground may be used as a place to forward vegetables. The walk is around the central stand. The height and dimensions will depend upon the plants protected.

HOTTENTOT BREAD. *Tamus* (*Testudinaria*) *elephantipes*. A South African climbing perennial, producing an immense above-ground tuber, very similar to the yam in flavour. It forms a large portion of the food of the natives.

HOT-WALLS. Walls in which heat circulates for the advancement of fruit, and ripening of the wood in the fall. They are made by conducting flues from a furnace at various heights, or back and forth, and terminating in a chimney; by enclosing steam pipes, or, what is much better, by building the wall hollow throughout, binding the two sides together occasionally by cross bricks or stones, and a coping, and passing a large hot-water pipe along the bottom between the sides: the heat from this rises upward, and produces an equal temperature throughout the wall.

Hot-walls are much assisted by a moveable arrangement of glazed sashes, which can be set up to protect the trees from frost in early spring, and may be removed during summer.

Ordinary walls, painted of a dark colour, and looking to the south, become heated by ten to twenty degrees higher than the adjacent grounds during summer, and therefore advance the ripening of fruits considerably, especially if all the leaves lying around the fruit be removed, which shade it from the sun or wall. The introduction of reflecting surfaces of white wood or sheet tin, so as to concentrate light and heat on walls, would doubtless much advance the maturity of fruits. Such reflectors might be moveable, made very light, and readily adjusted to heat any particular wall.

HOUND. The dogs of chase are so called.

HOUND'S TONGUE. The genus *Cynoglossum*: rough-leaved weeds of little value.

HOUSELEEK. Exotic plants of the genus *Sempervivum*, with succulent leaves, which are mucilaginous.

HOVEL. A shed for cattle, sheep, &c.

HOVEN, HOOVE. See *Oxen, Diseases of*.

HUCKLEBERRY. Whortleberry.

HUMAN FÆCES. See *Night-soil*.

HUMATES. Salts of humic acid. See *Humus*.

HUMECTATION. Moistening.

HUMERUS. The upper bone of the arm.

HUMIC ACID. See *Humus*.

HUMIFUSUS, HUMIFUSE. Spreading over the ground, procumbent, like the stem of the melon, sweet potatoe, &c.

HUMILIS. Low, humble, applied to small species.

HUMMELLER. An implement for the separation of barley from the glumes or awns. This may be done by the means described under barley. An instrument extensively used in Scotland is formed of a hollow cylinder of staves or metal, in which an axis revolves very rapidly. To the axis is attached three sets of cross pieces of wood, which reach nearly to the cylinder, and are at right angles to it. The barley being slowly admitted by a hopper above, enters the cylinder, where it is beaten rapidly by the cross pieces, and perfectly cleaned of awn by the time it escapes from below.

HUMMING-BIRD. Birds of the genus *Trochilus*, remarkable for their minuteness, brilliancy, and rapid flight. They live upon the nectar of flowers and on small insects.

HUMOUR. In anatomy, fluid secretions natural to the eye or other parts of the body.

HUMUS. The decayed carbonaceous residue of plants, of a dark-brown or black colour, and mouldy smell. It is called by gardeners vegetable mould, and has received the name of humus, humic acid, humin, humic extract, coal of humus, ulmin, ulmic acid, geine, geic acid, apotheme, &c., &c.

Being vegetable matter in a state of decay, its composition is subject to change ; and hence a great number of bodies will be formed by treating it with re-agents, as potash, soda. But Mulder has recently shown that the various bodies enumerated by other chemists, as well as the crenic and apocrenic acids, are no more than woody fibre, cellulose, starch, gum, sugar, and similar vegetable bodies in a progressive state of decay; that by the absorption of oxygen, carbonic acid and water are constantly being formed, and progressively the different products of decay. From Mulder we learn that ulmic or humic acid consists of 40 carbon, 14 hydrogen, and 12 oxygen ; crenic acid, C_{24} H_{12} O_{16} ; apocrenic acid, C_{48} H_{12} O_{14}, and that the two latter are not, as Berzelius and others assert, bodies containing nitrogen, but only that in the soil the apocrenic acid is usually combined with *ammonia*. Moreover, Mulder failed to discover in the vegetable mould or humus any other organic bodies than humin and its derivatives, with crenic acid and its derivatives, acting as acids. The bases with which apocrenic and humic acid are combined are chiefly lime and ammonia. The humates of lime, potash, and soda existing in the soil are either insoluble or sparingly soluble ; the humate and apocrenate of ammonia are soluble, and form a brown solution. Woody tissue, straw, leaves, and vegetable rubbish, exposed to air and kept moist, and at a temperature above 60, decay or run into eremacausis, producing at first ulmic, crenic, and apocrenic acids ; these will combine with bases present, and still continue to decay, giving out water and carbonic acid. The ammonia present participates in this change, and becomes converted into nitric acid. The rapidity of decay is much hastened by the presence of caustic lime, potash, or soda, or by their carbonates. If air be not freely admitted, then gaseous compounds of hydrogen, carburet of hydrogen, sulphuretted hydrogen, &c., are formed.

From this we learn that humus is vegetable matter in the act of decay, the products of which depend upon the age, exposure to air or water, temperature, and similar conditions. But there is a variety called *inert humus*, as peat, turf, &c., which, from the presence of moisture and absence of air, combined with other causes, decays very slowly ; this may, however, be hastened by drying and free exposure to air, by admixture with putrescent bodies, or by the action of lime and bases. The solution of humus, obtained by boiling potash or soda ash with peat, is not strictly a humate of these alkalies. The humic acid can be precipitated by adding the strong mineral acids. The portion of humus not soluble in alkaline solutions is called insoluble humus, humin, coal of humus.

Humus, *i. e.*, vegetable mould, has been highly commended as the food of plants, some people imagining that in the soluble state it entered the root and fed the tissues; this view, propagated for the purpose of exemplifying the utility of applying all manures in the state of solution, *is a ridiculous absurdity*. That solutions of humus find their way into the interior of plants, is very true; but it has never been shown that such solution was in any way necessary to vigorous growth. Indeed, plants set in soils containing only insoluble humus (humate of lime) are as healthy and vigorous as those growing under the influence of solutions. Numerous plants require no humus, as grasses, clovers, various forest-trees; these, indeed, by their dead leaves and roots, produce and accumulate humus. Charcoal powder, which is insoluble, answers, in many cases, equally well with humus.

The real utility of humus, irrespective of the ashes which mould contains, arises from the following effects: 1st. It is constantly decaying, and thus producing carbonic acid and water, which feed the plant and moisten the soil. 2d. During decay it constantly absorbs nitrogen from the air, which becomes converted into ammonia and nitric acid, and is thus admirably fitted to sustain vegetation. 3d. It not only imparts valuable mechanical qualities to the soil by increasing its warmth, porosity, and friability, but the carbonic acid produced, as well as the nitric acid, by acting on the insoluble minerals of the soil, as the silicates of potash, soda, lime, and its bone earth and other phosphates, dissolves or decomposes them, rendering them food for plants. In this manifold way humus becomes of great utility to culture, but is neither the only manure, nor competent of itself to produce fertility; for accumulations of humus are by no means desirable: 10 per cent. in the soil is an abundance, and two to three per cent. is quite enough for most plants. Potatoes, the roots, corn, cotton, tobacco, cruciferous plants, and wheat, are most partial to this body; they are all plants developed by culture, and require a supply of food by the roots as well as leaves. Grasses, clovers, and many beans increase instead of exhausting the soil of humus; hence their utility in rotations.

The amount of humus in the soil is readily increased by green fallows, by ploughing in straw, prepared peat, and all vegetable rubbish. The greater part of the solid matter of all putrescent manures is humus, decayed wood, the rotten interior of the trunk and branches, &c.

Humus is hastened in its decay, and consequently in the several effects it produces, by *liming* and the *use* of *ashes*, as well as by hoeing and all means that increase the quantity of air admitted to the soil. Indeed, much of the surprising effect that lime often exhibits arises from its action on the vegetable matter in the soil; even cornstalks and twigs of trees are rapidly reduced by its action when in the earth.

HUNDRED WEIGHT, or CWT. 112 pounds avoirdupois. It is common in the United States to speak of hundreds, or 100 pounds; and 100 pounds is frequently called a hundred weight.

HUNGER-ROT. Disease occasioned in sheep by bad keeping; starvation.

HUNGRY SOIL. Poor, sandy, or gravelly soil, requiring frequent manuring.

HURDLE. A light, moveable fence of wood, iron, or wire; it resembles a light gate, and is sometimes made of osiers, woven like a basket. See *Fence*. Sheep are *hurdled*, *folded*, or enclosed on turnips, clovers, grass, &c., by means of hurdles, and readily shifted from place to place. The shifting often takes place daily, and if the manure dropped be ploughed in as soon as the shift is made, a considerable economy is practised; but if it be left to dry and waste, the plan is bad.

HUSBANDRY. Agriculture. The following short sketch of British husbandry may be found serviceable; it is by Mr. Rham:

"The first and most inartificial is that which consists in breaking up portions of pasture land and sowing corn on a slight ploughing, which cannot fail to be productive for some time. Several crops may thus be taken, until the land is so exhausted that the crop no longer repays the seed and labour. To extend this time, experience soon pointed out the crops which succeeded best after each other. Wheat or barley were probably the first crops; afterward pease, beans, or oats, until the ground, being overrun with weeds, would be left to the renovating effect of time, and a fresh spot would be broken up.

"The first improvement on this system is that of infield and outfield. The infield is cultivated more carefully, somewhat like a garden, and all the dung of the cattle is exclusively put upon this part. The outfield is a continuation of the first-mentioned system. The infield consisted of enclosures or open fields near the dwelling, which it was most convenient to cultivate as arable land. Thus two distinct systems of husbandry were carried on at the same time; and whatever improvements were introduced in the management of the infield, the outfield continued to be managed as it was before.

"The mode of recruiting lands which had been exhausted by crops, or were overrun with weeds, by means of a fallow, seems to have been introduced into England by the Romans. The alternate crop and fallow seem to have been later introduced than a fallow after several crops. The triennial system, which consists of a summer fallow, a winter crop, and a spring crop, was probably longer established than any other, and is still the practice in many parts of England. The deteriorating effect of the outfield system would lead to its abandonment as soon as population increased, and with it the want of land for infield.

"When common fields are divided and enclosed, a better system of husbandry generally follows. Clover and turnips are more regularly sown, and, on the light lands, take the place of summer fallow. Clover generally comes after a crop of wheat, in which it was sown the preceding year in spring; and as most crops succeed well after clover, wheat was usually chosen for the next crop as the most profitable. Thus arose the Norfolk system, without any very sudden departure from the old rotations. Two crops raised for the food of animals in four years require more cattle on the farm to expend them profitably; and thus more manure is made. In the light soils the sheep, when folded on the turnips, not only enrich the land by their dung and urine, but likewise render it more compact by treading it, which is advantageous to the clover and wheat which come after. If the land is a good loam, beans are sometimes sown after wheat, the land having been recruited with manure; and if the beans are kept clean by hoeing, another good crop of wheat may be obtained after them. Thus arises the improved rotation of turnips, barley, clover, wheat, beans, wheat; after which the land is again cleaned and prepared for turnips with all the manure that can be spared. As in this system there is always a crop with succulent leaves intervening between two which have a white straw, it has been called the *alternate* system of husbandry. These are the most common systems in England. The removal of the fallow year, provided the land be kept clean, is a decided step towards improvement; the best farmers effect this by the introduction of artificial grasses and tares fed off by sheep, and especially by sowing every crop in rows and keeping the intervals stirred, which is a partial fallow, without losing a crop. Here Tull's system is introduced, which in its complete state, as the author recommended it, was soon abandoned.

"As the English systems have taken their origin chiefly from the infield cultivation, so the Scotch appear to have arisen from that of the out-field. Fallows were unknown, but the invigorating effect of grass fed off by cattle must soon have been perceived; and, instead of leaving the land to recover slowly by the spontaneous growth of natural herbage, which on poor land takes a long time, it was obvious that this might be accelerated by sowing grass seeds. Hence the origin of the Scotch convertible system of husbandry, which is gaining ground daily, and bids fair, in remote situations, where no manure can be purchased, to be firmly established. The order of the conversion has been somewhat altered from what it was originally. Instead of sowing grass seeds after the land is exhausted, it has been found advantageous to accelerate the growth of grass by manuring the crop in which it is sown; and experience has proved, that the richer the grass is, the more productive are the crops which come after. The grass, instead of being a mere substitute for fallowing and manuring, is made highly profitable by feeding cattle and sheep; and the profit of the years when the land rests, as it were, by being depastured, is often as great as that of the years when it is cropped; and the risk and expenses are much less. The convertible system is not very generally known or adopted in England, and is often confounded with the alternate system. The alternate system interposes a green crop between two white-straw crops. On good land the convertible husbandry may consist of three or four years' tillage and three years' grass. If the land is not quite clean, a summer fallow on heavy soils, or a turnip fallow on light soils, should begin the course; and only one crop should be taken after the fallow in which the grasses are sown, whether it be wheat, corn, barley, or oats. It should be fed off the first year, mown the second, and fed off again in the third; when it is broken up, oats are usually sown as the first crop in Scotland, then beans, if the land admits of them, and then wheat. If a fallow is intended, a crop of pease may be sown after the wheat, and then the course begins again, as before, with a clean fallow or with turnips. In this manner the land may be kept clean and continually improve in fertility by means of the cattle which are kept upon it, without the aid of any purchased manure, except lime, the expense of which is, in most cases, well repaid by the crop. These are the only regular systems in Britain, and every mode of cultivation and cropping may be reduced to one of them, unless it be capriciously anomalous.

"What renders the improved systems of British husbandry so superior to that of other nations is the attention paid to the perfection of the different breeds of domestic animals, especially the horse, the ox, and the sheep. In this respect, British husbandry surpasses every other. No expense or trouble is spared to improve the qualities of cattle and sheep. It has been objected, that the rewards given by different societies for excessively fat cattle are not judicious, as these animals are never profitable to the feeder. The same might be said of very high-bred race-horses; they are not so useful as a good hackney or hunter; but unless some individual animals possess the power, courage, and speed which is the mark of the best blood, it would soon degenerate; so, likewise, if some oxen were not occasionally fatted to an extraordinary degree, the fatting qualities of the breed could not be proved. A badly-bred ox will never become so fat, whatever food may be given him, as one of a choice breed; this the breeders are well aware of, and never hesitate to pay a good price for a young bull related in blood to a prize ox."

HUSK. The dry exterior of fruits.

HYACINTHINE COLOUR. The colour of the hyacinth gem: a clear reddish-brown.

HYALITE. A variety of glassy quartz of a gray or yellowish colour, and concretionary.

HYALOID (from ὑαλος, *glass*). A transparent membrane.

HYBERNACULUM. The winter leaf-bud.

HYBERNATION. The torpid condition in which numerous animals and reptiles exist during winter; they usually retire in a fat state, and become very lean by spring, the fat being consumed in maintaining the temperature necessary to preserve life.

HYBRID (from ὑϐρις, *a mule*). The offspring of animals or plants of different species. They are usually barren, as mules, or yield only by connexion with one of the same race as the parents. Much of the improvement in horticulture has been effected by *hybridizing*. To perform this, the plants selected should be of near varieties, and of similar qualities; they should also flower at the same period. The flowers on the female plant are to be reduced to a few only, and its situation must be distant from others of the same variety. The stamens of all the flowers are to be cut out by a pair of scissors as soon as the blossom is developed, and before pollen is emitted; and as soon as the stigma is fully dilated, staminate flowers from the male variety are to be brought and shaken over them, care being taken that the pollen is well scattered over the stigma. The seed germinates readily, and will produce a new variety that may be valuable, and is to be maintained by slips, cuttings, buds, and any other means except by seeds, which are either infertile or defective. This was a favourite method with Mr. Knight. Hybrids are frequently formed in gardens by the close neighbourhood of varieties, the pollen being carried by wind, insects, &c., and they frequently destroy fine seeds. Hence, plants raised for seed should be planted apart, and out of the reach of the pollen of other varieties. *Bigeners*, the hybrid offspring of plants of different genera, are very rare.

HYDATID (from ὑδατις, *a bladder*). A race of entozoic animals resembling a small bladder, and infesting the liver, brain, uterus, and other parts of mammals. See *Diseases of Sheep*.

HYDRACIDS. Acids containing hydrogen, as muriatic acid, &c.

HYDRAGOGUE (from ὑδωρ, *water*, and αγω, *I expel*). Violent cathartics, which cause an expulsion of much fluid.

HYDRANGEA. A highly ornamental flowering shrub.

HYDRARGILLITE. A name for wavellite.

HYDRATES. Compounds in which water combines, as an acid in its equivalent of nine, as *hydrate of lime*, or water slacked lime.

HYDRAULICS (from ὑδωρ, and αυλος, *a pipe*). The science which treats of the movement and mechanical effects of water and liquids.

HYDRO. A chemical prefix, indicating the presence of hydrogen; as hydrochloric, hydrobromic, hydrocarbon, and hydriodic.

HYDROCARBONS. A general term for the oily, waxy, and resinous products of vegetation, which are rich in hydrogen, and often contain hydrogen and carbon only; they are also called *hydrocarburets*, which term includes ethers, alcohols, gaseous compounds of carbon with hydrogen, naphthas, &c.

HYDROCELE. A collection of water in the scrotum.

HYDROCHLORIC ACID. See *Chlorine*. Muriatic acid.

HYDROCHLORATES. An old term for chlorides.

HYDROCYANIC ACID. Prussic acid, a pellucid fluid, of strong odour, one of the deadliest poisons known. Ammonia is the best antidote. It is a compound of one eq. cyanogen and one hydrogen, and produced in the distillation of bitter almonds, peach blossoms. Numerous plants of the rosaceous family contain a portion of it. See *Cyanogen*.

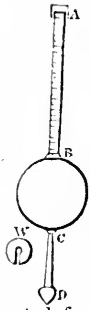
HYDRODYNAMICS (from ὑδωρ, and δυναμις, *power*). The science which shows the methods of applying the properties of fluids to mechanical purposes.

HYDROFLUORIC ACID. A pungent, gaseous acid formed of one eq. fluorine, and one hydrogen. See *Fluorine*.

HYDROGEN. Inflammable air. The lightest body in nature: an elementary gas, without odour or colour, very inflammable in air, forming explosive compounds with oxygen. It has little chemical activity alone, and is irrespirable: 100 cubic inches weigh 2·13 grains. Its equivalent is 1 on the hydrogen scale, and 12·5 on the oxygen: symbol H. Hydrogen does not exist uncombined in nature; but in a compound state, in water, ammonia, and vegetable products, is largely accumulated. It combines with oxygen, forming water, by the aid of heat or electricity. In all its properties hydrogen resembles a metal. It combines with oxygen, chlorine, bromine, &c., in the same way as other metals, and is readily displaced by the greater number, sometimes with the evolution of pure gas, at others by the simultaneous combination of the liberated hydrogen with oxygen, to form water. Its compounds with carbon, forming coal gas and oil gas, are of considerable economical value: these, with sulphuretted hydrogen, are also thrown out from wet, putrescent manures, stagnant ditches, &c. For other compounds, see the usual names.

Some writers state that plants possess the property of decomposing water and appropriating its hydrogen; but this has never been proved: the decomposition is readily effected by galvanism. Plants contain six to seven per cent. of hydrogen in the dried portions without the water, in which there is one ninth by weight: fats and waxes contain ten to thirteen per cent.

HYDROMETER. Areometer. An instrument to take the specific gravity or density of fluids, spirits, &c. It is of great value in testing the strength of spirits, of solutions, of sugar, dyestuffs, &c. The form of the implement, which is made of brass or glass, is shown in the figure. It is sometimes furnished with a series of weights, W, which are pla-



ced on the short stem, C D, to enable it to sink in different solutions. The stem A B is usually flat and graduated; the scale depending upon the use, and varying with the maker. Sykes's instrument, which is used for taking the strength of spirits, is furnished with a table. Baumé's areometer, or hydrometer, is extensively used by sugar-makers and manufacturers. It is graduated from a central point in the stem,— upward, for fluids lighter than water, and + below, for those that are heavier. The 0 (zero) marks the density of distilled water at 58° Fahrenheit, and the downward marks correspond to the density of solutions of salt and water, containing for each mark an additional one per cent. of salt; thus, 5° indicates a fluid of the same density as that produced by mixing 5 parts common salt and 95 water. The real specific gravities are,

For	Fluids of less gravity.
0 = 1·0000	− 11 = 0·9932
+ 1 = 1·0066	− 12 = 0·9865
+ 5 = 1·0340	− 15 = 0·9669
+ 10 = 1·0704	− 20 = 0·9359
+ 20 = 1·1515	− 25 = 0·9068
+ 30 = 1·2459	− 30 = 0·8795
+ 40 = 1·3571	− 35 = 0·8538
+ 50 = 1·4902	− 40 = 0·8295
+ 60 = 1·6522	− 45 = 0·8066
+ 70 = 1·8537	− 50 = 0·7849
+ 76 = 2·0000	− 60 = 0·7449

HYDROPHILIDÆ. Aquatic, pentamerous beetles. They are vegetable feeders.

HYDROPHOBIA. See *Dog*.

HYDROPHYTES (from ὑδωρ, and φυτον, *a plant*). Plants living in fresh water.

HYDROSTATIC BALANCE. The common balance, furnished with a scale that may be suspended near the beam, and under which a hook is placed to hang any substance to be weighed in water. See *Gravity, Specific*.

HYDROSTATIC PRESS. See *Press, Hydraulic*.

HYDROSTATICS (from ὑδωρ, and σταω, *I stand*). The science which explains the mechanical properties of fluids.

HYDROSULPHURIC ACID. Sulphuretted hydrogen. See *Sulphur*. Hydrosulphurets are the sulphurets or sulphides of metals and bases.

HYGEINE (from *ὑγιεια, health*). The arts necessary to the preservation of health.

HYGROMETER (from *ὑγρος, moist*, and *μετρον, a measure*). A contrivance or implement to measure the amount of moisture or vapour of water in air. Formerly hygrometric substances, as hair, catgut, whalebone, sponge dipped in pearlash, &c., were used; but their indications are of little value. The plan of ascertaining the *dew point* (see) is the simplest; this may be done as directed under dew point, with the hygrometer of Professor Daniel, or by a simple implement of Professor Bache, which consists of a small bar of polished steel, in which several perforations are made, at short intervals, large enough to receive the bulb of a small thermometer. When used, one end of the bar is plunged in iced water, the other being sustained in the air: after a short time, dew will be seen to form near the lower parts, and to rise gradually until it attains a stationary point. If the thermometer be now placed in the nearest aperture, it will indicate the temperature of the dew point, or the hygrometric condition of the air. If the place occupied by the dew be situated between two perforations, the thermometer may be placed in both, and one half the difference added to the degree of the lower, to mark the dew point.

The real amount of water in a given bulk of air is not measured by any instrument. It is, however, a matter of calculation. From Professor Daniel's table, it appears that at a dew point of 30° Fahrenheit, there is about 2½ grains of water in a cubic foot of air; at 40°, 3¼ grains; at 50°, 4½ grains; 60°=6¼ grains; 70° Fahrenheit = 8⅓ grains; at 80° Fahrenheit, 11¼ grains.

HYGROMETRIC, HYGROSCOPIC. Having the quality of absorbing moisture during wet, and partially losing it in dry weather.

HYGROSCOPE. The hygrometer.

HYLOBIUS. A genus of tetramerous beetles, resembling the *curculios*, and infesting trees.

HYMENIUM. The gills or porous membranes in which the spores of fungi are placed.

HYMENOPTERANS, HYMENOPTERA (from *ὑμην, a membrane*, and *πτερον, a wing*). An order of mandibulate insects, comprehending those which have four membranous wings with few nervures. Latreille divides this order into the following sections and tribes:

1. *Terebrantia:* Abdomen of the females furnished with a saw or borer.
   - a. *Securifera:* Abdomen sessile, furnished with a saw; larvæ with feet.
   - b. *Pupivora:* Abdomen pedunculated, furnished with a borer; larvæ footless.

2 *Aculeata:* Abdomen of the females armed with a sting.
   - a. *Heterogyna:* Females wingless.
   - b. *Fossores:* Females winged, wings not folded; basal joint of posterior tarsi simple.
   - c. *Diploptera:* Females winged, wings folded.
   - d. *Mellifera:* Females winged, wings not folded; posterior tarsi enlarged, and converted into a pollinigerous organ.

HYPERSTHENE. A species of mineral resembling hornblend, with little lime and twenty-four per cent. iron. In some greenstone rocks it takes the place of hornblend.

HYPERTROPHY. An unusual increase in size of any organ of the body.

HYPOCHONDRIUM. The region of the body under the cartilages of the false ribs. The liver lies in the right, and the spleen in the left hypochondrium.

HYPOCRATERIFORM. Salver-shaped. A corolla consisting nearly entirely of a tube.

HYPOGASTRIC REGION, HYPOGASTRIUM (from *ὑπο, under*, and *γαστηρ, the stomach*). The portion of the abdomen reaching from the lowest parts to near the navel.

HYPOGENE ROCKS. The crystalline rocks, both stratified and unstratified, as granite, gneiss, mica, and hornblend slates. These are either rocks of fusion (*Plutonic*), or have been modified by heat (*Transition*).

HYPOGYNOUS (from *ὑπο*, and *γυνη, a female*). Stamens, or other organs, attached below the base of the ovarium.

HYPONITROUS ACID. A very instable and unimportant acid, composed of 1 eq. nitrogen and 3 oxygen.

HYPOPHOSPHOROUS ACID. A compound little known, with acid properties; it has not been isolated, and consists of 1 eq. phosphorus and 1 oxygen.

HYPOPHYLLUM. A partial leaf, clasping the stem, and without lamina.

HYPOSULPHURIC ACID. An instable body, not isolated, composed of 2 sulphur, 5 oxygen. *Hyposulphurous* acid is not isolable; consists of 2 S+2 O.; its salts, the *hyposulphites*, are of use in photography: they are very readily decomposed.

HYPOTENUSE. The longest side of a right-angled triangle.

HYPOTHESIS. A speculation not based on facts, but explaining certain phenomena.

HYSSOP. *Hyssopus officinalis*. A perennial rooted, labiate plant, of aromatic and bitter properties. It grows on a dry, light soil, and is propagated by cuttings and seeds.

HYSTERIA. A nervous complaint, attended with convulsions and peculiar flatulency.

HYSTRICIDÆ (from *hystrix, a porcupine*). The family of *Rodentia*, to which the porcupine belongs.

I.

IBEX. A wild goat (*Capra ibex*) inhabiting the mountains of the Old World, with long horns, marked with knotted ridges.

ICE. Water congeals at and below 32° Fahrenheit, and expands $\frac{1}{9}$th of its volume at 40° Fahrenheit; hence, when freezing occurs in the pores of rocks, the earth, &c., it often produces a disruption of the particles. It is this action that mellows lands ploughed in the fall.

ICE-HOUSE. A sandy or porous soil is to be preferred; the place should have a northern aspect, and be protected by trees, a wall, &c., from the action of the sun. The pit may be conical or rectangular, with sloping sides; for a family, twelve to fourteen feet depth, and twelve feet square, will be sufficient, but some houses are twenty-four feet deep; the sides may be bricked and cemented, or lined with wooden piles cut from small pines, and set horizontally, as in making a log house, and afterward boarded; the framing may rise one or two feet above the ground, and a quantity of earth be rammed against it. At the bottom, a well three or four feet deep, and one third the width of the pit, should be dug, and covered with timbers or an iron grating; into this the water of the melted ice drains and is removed; if the soil be porous, nothing more is wanting, but if retentive, a drain must be made from the bottom to carry off the water; this is to be protected with a water-trap to hinder circulation of air. If a sandy bed be supposed to exist at a short depth, it is best to sink the well to it, or, at least, to make an open bore; unless the water can be drained, the ice will not keep.

The roof may be a sharp gable or conical, well protected by shingles or thatch; the door is to be on the north side, and should lead along a short passage to a second inner door. A gutter must be placed around the eaves to carry off every drop of rain.

The house should be filled in dry, frosty weather; if of wood, the ice may be thrown directly in, but in stone or brick houses a layer of straw or leaves may be first spread on the bottom. The clearest ice is best; it should be driven closely together with a rammer, and, as the house fills, straw or leaves may be placed around the sides. If the weather be very cold, water may be thrown over tho ice, so as to freeze and consolidate the mass, otherwise the crevices should be filled with small or broken pieces. If the house has been filled early, it is customary to leave it uncovered until the new year, so as to add to the mass as it settles during February. As soon as the winter is passed, the top should be well covered with dry leaves or straw. A ladder is used to reach the ice, and, placed upon it as soon as necessary, it remains during the season. Snow, well rammed, keeps well, especially if water be frozen amid it.

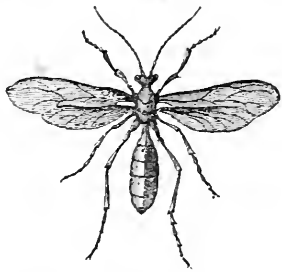
Some houses are made with a double lining, the outer being of piles and the inner of plank, the space between them varying from four to eight inches, and filled with pounded charcoal, sawdust, dry tan, or leaves well rammed. In this way a non-conducting pit is made that will keep less quantities of ice very perfectly. Such a house may even be made above ground, if surrounded with a thick mould of earth, and kept free from wet and well drained.

The uses of such a house are apparent: meats, liquids, butter, fruits, are preserved; but, besides these, in silk raising, it affords the means of delaying the hatching; scions may be kept back, and, above all, the ice is invaluable in the sick-chamber in inflammations.

ICE PONDS. Any natural lake or accumulation of clear water will furnish fine ice; but where that is wanting, a temporary dam thrown across a spring branch will soon produce a sufficient amount of water. Where the operation of taking ice is carried on on a large scale, the surface is cut by a plough of suitable construction, and thus the removal assisted. The Boston dealers take only the transparent ice; they have any accumulation of snow shaved off by skim-coulters a few days before use, and the thickness of the real ice is rapidly increased afterward. The largest blocks are preferred for storage; and as they are cut of the same size, they can be laid in the house like courses of masonry.

ICELAND SPAR. Calcareous spar.

ICHNEUMON FLIES. Small hymenopterous insects, which lay eggs in the bodies of aphides, caterpillars, and other insects, and even in the eggs of these; the young eat and destroy the creatures in which the egg is deposited. The *Fig.* represents a common species (*Trogus fulvus*).



ICHOR. A thin, purulent, and acrid discharge.

ICOSANDRIA, ICOSANDROUS (from *εικοσι*, *twenty*, and *ανηρ*, *a male*). Flowers with 20 stamens.

ICTERUS. Jaundice; hence *icteroid*, yellowish, like the colour of the skin in jaundice.

IDIOPATHIC. Independent of other diseases.

IDIOSYNCRASY. A peculiarity of constitution.

IDOCRASE. Volcanic garnet. It crystallizes in a square-based prism of a brownish colour, and is found massive. Composition of the Vesuvian: silica, 35·5; alumina, 33; lime, 22·25; iron, 7·5.

IGASAURIC ACID. A vegetable acid found in plants yielding strychnine.

IGNIS FATUUS. A luminous meteor seen over marshes; it consists of marsh gas (light carburetted hydrogen) inflamed.

IGNITION (from *ignis*, *fire*). Combustion, burning.

ILEUM. The lower portion of the small intestines.

ILIA. The lower sides of the abdomen; hence *iliac*, *iliacus*, related to the ilium.

ILIAC PASSION. A violent colic, in which feculent matter is vomited.

ILIUM. The haunch bone.

IMAGO. The winged insect.

IMBRICATED. Overlapping, like the shingles of a roof.

IMPACT. The concussion of one body on another.

IMPENETRABILITY. An essential property of matter, whereby one molecule only can occupy a given space at a certain time.

IMPETUS. The force or momentum of a body in motion.

IMPERMEABLE. Rendered water-proof; this may be done with cotton, silk, or other cloths by saturating with drying linseed oil; linseed oil holding in solution India rubber; a varnish made by dissolving India rubber in naphtha; by pitch; a solution of glue applied to cloth, which is afterward dipped in infusion of galls.

Impermeable, in physics, also means capable of resisting the passage of gases as well as fluids.

IMPINGE. To strike upon; a word much used in optics to express the incidence of light.

IMPLEMENTS. Suitable care should be taken in keeping them free from rust and unnecessary exposure; parts subject to movements should be kept oiled, and the whole stored in a dry place in the barn.

IMPONDERABLE. A term used to express light, heat, or electricity, which are destitute of any discoverable weight.

IMPOSTHUME. An abscess.

IMPREGNATION. Conception. In horticulture, the contact of pollen with the stigma is called impregnation; without this, no seed is produced. Artificial impregnation is called hybridizing. See *Hybrid*. By it numerous choice fruits, vegetables, and flowers have been produced.

IMPROVEMENT OF LANDS. See *Barren Land* and *Arable Land*.

IMPROVEMENT OF PLANTS. The chief means are manuring, careful tillage, proper exposure to sun or shade, pruning, summer pruning, hybridizing, securing fine seeds. Improved varieties are maintained by grafting, slips, parting the roots, and high culture; without the latter, annuals degenerate. Nature often volunteers an improvement, which the orchardist should at once avail himself of by propagation, and by carefully collecting the seeds. In this way several varieties of wheat, or other plants, sown together occasionally, exhibit a new kind, superior to the rest, the seed of which must be carefully separated and sown alone on excellent soils.

INANITION. A state of languor, emptiness.

INARCHING. A kind of grafting, in which the scion is not cut from its parent, but the scion and stock are made to come together at a certain place; they are then both pared down to the new wood, and a tongue made in each wound, so as to enable them to fit closer; the two are then bound together (the parts being adjusted) by bass and grafting clay, and supported by a stake driven in the ground. The plants should be shaded, most of the buds removed, and the stock headed down nearly to the scion. When the parts are firmly united, which requires three or four months, the scion is cut from its parent. This process is sure, but troublesome. The scion may be sometimes a slip, the heel of which is kept in water. The operation is performed in April or May, and usually on jessamins, myrtles, camellias, wallnuts, and firs.

INCANDESCENCE. A luminous heat.

INCANUS. Hoary; covered with a whitish down.

INCH. The twelfth part of a foot.

INCIDENCE. The meeting of one body with another. The angle of incidence is formed by the direction of the light to a line perpendicular to the plane of the surface on which it falls.

INCINERATION. Burning to ashes.

INCISED. Cut with a sharp knife.

INCISIONS IN TREES. Drawing a sharp knife through the bark and into the new wood of plum, cherry, and other trees, is often very serviceable when they are bark-bound. It should be done in summer, and the incision made from the branches to the earth.

INCISORS. The sharp cutting or nipping teeth placed in front of the mouth of animals.

INCOMBUSTIBLE. Not capable of burning. Cloths and wood are rendered almost incombustible by soaking in a solution of borax, alum, sal ammoniac, phosphate of soda, &c. The metallic salts used in preserving timber render it very incombustible; it smoulders, but does not burn with flame.

INCOMPATIBLES. Substances which cannot exist in solution without decomposition.

INCUBATION. Hatching. This may be done by artificial heat distributed through a chamber by steam: the temperature is about 102° Fahrenheit. See *Gestation*. A contrivance for artificial hatching, called the Eccaleobion, has been exhibited in New-York.

INCUMBENT. In botany, leaning against.

INDEHISCENT. In botany, a fruit which does not open when ripe, as succulent berries.

INDIAN BLACK DRINK. See *Holly*.

INDIAN CORN. See *Corn*.

INDIAN CRESS. The nasturtion.

INDIAN HEMP. See *Hemp*.

INDIAN MILLET. See *Millet*.

INDIAN PHYSIC. *Gillenia trifoliata*. An indigenous herb, the perennial root of which is a good emetic.

INDIA RUBBER. Caoutchouc. The dried milky juice of the *Siphonia elastica*, and other euphorbiaceous trees. It is a compound of 90 carbon and 10 hydrogen, or $C_3 H_2$. India rubber is much used in the laboratory to unite tubes, &c.

It is dissolved by coal naphtha, forming a varnish, which, brushed on cloth, renders it water-proof; two pieces of cloth are used, the varnish rubbed on one, and the other brought at once into contact; they adhere firmly. Linseed and other fixed oils dissolve a small amount of caoutchouc; pure ether has the same property.

When heated to 600°, it throws up a vapour, which, by refrigeration, is obtained as a volatile fluid, called caoutchoucine. This is a remarkable solvent of common India rubber resins, especially copal, and many oils.

INDIAN TOBACCO. See *Lobelia*.

INDIAN TURNIP. *Arum triphyllum*. Wake-robin. A common marsh plant, the bulbous roots of which contain much starch, and are occasionally eaten, after being dried, but it is acrid when fresh.

INDIGESTION. This is characterized by loss of appetite, flatulency, uneasiness over the stomach, irregularity of the bowels, and imperfect dejections. It requires to be treated by exercise, gentle purges, change of diet, abstemiousness, and tonics.

INDICATION. The particular treatment indicated by the symptoms of a disease.

INDIGENOUS. Native plants, &c., are so called.

INDIGO. A blue dye-stuff procured from many leguminous plants, but chiefly from the *Indigofera tinctoria* (*Fig.*), which is cultivated in the

East and West Indies, the continent of America, and the United States, as it yields the largest amount of colouring matter. In Guatimala, the shrubby, *I. disperma*, yielding a superior dye, is cultivated. Ure, also, states that the *I. pseudo tinctoria* of the East Indies furnishes the best indigo. The most successful culture of these plants is near the tropics, where the mean temperature reaches 75° and 80° Fahrenheit; but species of indigofera grow to the north of this position. The soil should be light and rich; the seeds are sown in April in drills, run at distances from 15 to 20 inches apart; they require moisture, but should not be planted in an undrained soil. Twelve pounds of seed answer for the acre. The young plants are to be kept free from weeds, thinned, and hoed up. The plants are cut with a reaping-hook near the earth, when about to flower, or as soon as the lowest leaves begin to turn: this period will be in July in South Carolina. A second crop is taken at the end of August, and a third crop in Guatimala and India. The root stems also yield good indigo a second year in rich soils, but one year is usually the term for successful cultivation. The first crop is the best. The excellence of the indigo will depend upon the brightness of the season; long-continued wet weather produces large plants, but a smaller quantity of die.

Preparation of Fresh Leaves.—The harvested plants are at once carried to a vat or steeping-tank of wood or masonry; here they are immersed in water, being kept under by weighted boards; fermentation soon begins, and is allowed to continue about 18 hours, during which the colouring matter is extracted from the leaves. The fermenting vat is some 20 feet square, and two to three feet deep, and the bottom set on a level with the top of a second or mashing-tank. As soon as the scum produced in fermentation begins to subside, the liquid should be allowed to flow into the lower vessel. The decanted fluid is of a yellowish tinge; when in the mashing vessel, it is to be violently beaten with paddles or other means for an hour or more, when the blue begins to form in flocks and precipitate. At first there is much froth, but this subsides as soon as the flocks become granulated; the beating is stopped when the granulations occur, and the fluid begins to clear if allowed to stand. If the fermentation has been defective, the froth is very abundant, and must be allayed by pouring oil over the surface; if over-fermented, a thick fatty crust covers the liquid, which does not disappear on introducing oil. In this case the beating or churning is to be moderated. The indigo precipitates during 20 hours, leaving the water transparent and free from froth. The surface water is now to be drained off by stop-cocks or plugs in the side of the vessel. In Central America, the thick semifluid mass of indigo is scraped up and placed on a stout cloth, to drain and dry in the sun, and afterward cut into small pieces for the market. Stove-drying is equally effective. When dried, any white efflorescence that appears should be wiped off. Limewater is sometimes used to assist the precipitation of the indigo; but it is not advisable, as the colour is injured.

Preparation of Dried Leaves.—In India the plants are sometimes carefully dried in the sun, the leaves thrashed from the stems, and stored in barns until enough is accumulated for sale or manufacture. The leaves change, in four or more months, from green to a blue gray in the mass, and then become ready for use. They are placed in the steeping-vat with six times their weight of water, and continually stirred for two hours or more, until the floating leaves sink. The solution is now green, and to be immediately run off into the mashing-vat, where it is treated as before. There is no fermentation in this process. Limewater is sometimes used to hasten the granulation, but is not necessary, except in the case of plants which yield little colour, as woad (*Isatis tinctoria*).

In some cases the leaves are pounded; the solution is then strained before beating.

The product of indigo in South

Carolina and Louisiana averages 65 pounds the acre: in Guatimala, 112 pounds is obtained on good soils. The low price of labour in India tends to the discouragement of the cultivation of indigo in the United States; it is, however, raised for plantation purposes. The following is a sketch of the plan in the South for this object, by the Southern Agriculturist; it produces an imperfect article, but good enough for the planters' use:

"Cut the indigo when the under leaves begin to dry, and while the dew is on them in the morning; put them in a barrel, and fill this with rain water, and place weights on to keep it under water. When bubbles begin to form on the top and the water begins to look of a reddish colour, it is soaked enough, and must be taken out, taking care to wring and squeeze the leaves well, so as to obtain all the strength of the plant; it must then be churned (which may be done by means of a tolerably open basket, with a handle to raise it up and down) until the liquor is quite in a foam. To ascertain whether it is done enough, take out a spoonful in a plate, and put a small quantity of *very strong lye* to it. If it curdles, the indigo is churned enough, and you must proceed to break the liquor in the barrel in the same way, by putting in lye (which must be as strong as possible) by small quantities, and continuing to churn until it is all sufficiently curdled: care must be taken not to put in too much lye, as that will spoil it. When it curdles freely with the lye, it must be sprinkled well over the top with oil, which immediately causes the foam to subside, after which it must stand till the indigo settles to the bottom of the barrel. This may be discovered by the appearance of the water, which must be let off gradually by boring holes first near the top, and afterward lower, as it continues to settle. When the water is all let off, and nothing remains but the mud, take that and put it in a bag (flannel is the best), and hang it up to drip, afterward spreading it to dry on large dishes. Take care that none of the foam, which is the strength of the weed, escapes; but if it rises too high, sprinkle oil on it."

Indigo is found in numerous leguminous plants besides the indigofera, as the *Baptisia;* it also exists in the *Polygonum tinctorium*, in species of nerium and isatis. One plan of discovering the presence of this colouring matter in any leaf is to place it in strong ether until the green is extracted, and it becomes white or of a light yellow; then expose this freely to the air, and if indigo be present, the colour is changed to blue.

Chemical Observations and Dyeing. —The lumps sold in commerce for indigo are a mixture of several bodies, as gluten, or gliadine, brown, red, and blue colours; lime, and other mineral substances. The proportion of blue colour varies from 19 to 75 per cent., according to the experiments of Ure, the rich purple, violet-coloured samples being best, and the East Indian generally superior to the Guatimala. It is insoluble in water, alcohol, or dilute acids. The blue indigo sublimes at 554° Fahrenheit, with a purple smoke, and forms purple, shining scales, but much is destroyed. The sublimed indigo consists of carbon, 73·1; oxygen, 12·1; nitrogen, 10·8; hydrogen, 4. Indigogene, of $C_{45} H_{15} N_3 O_4$.—(*Dumas.*)

Indigo is readily dissolved in strong sulphuric acid, seven to eight times the weight of commercial oil of vitriol being necessary; this is called solution of indigo, sulphate of indigo, Saxon and chemical blue, and is extensively used for dyeing. It may be prepared in quantity and kept, and is sold at the proper stores. To make it, the acid must be placed in an earthen-ware dish, surrounded with water to keep it cool, and the pounded indigo added, with stirring, in small quantities; when it is dissolved, the whole is covered and left for 48 hours; it is then mixed with twice its weight of pure water, and bottled. This solution contains the indigo, red and brown colours, and gluten, and does not produce a clear dye. It may be purified by adding the solution to a considerable amount of boiling water, and putting into it wool to macerate in the cold for 24 hours. The wool becomes deep blue, and should remain until the liquor is greenish blue; it is then to be taken out, drained, and washed in a stream of pure water until the fluid ceases to be coloured or acid. The washed wool is next to be placed in a copper full of water, containing two per cent. of pearlash, or carbonate of soda (or three times the weight of indigo), and kept boiling a quarter of an hour; The pure blue (sulphate and hyposulphite of indigo) colours the water, the wool remaining dyed a dirty brown (indigo red): the solution may be used as a dye, yielding a bright, good colour, called distilled or soluble blue.

Wools and other textures are first boiled in alum before being permanently dyed in the soluble blue, the depth of tone being increased by several applications of alum and immersions in the solution; it also serves to make olives, greens, and other mixed colours.

Other means of dyeing are extensively used, founded on the property of indigo to become soluble in alkaline solutions, or limewater, and colourless when brought in contact with a deoxydizing substance, as green vitriol, and recovering its hue on subsequent exposure to air. The indigo (indigogene) may be thrown down from solution by acids as a white body, of which blue indigo is supposed to be the oxide. The most common means of dyeing is the *cold* or *copperas vat*; this is made as follows: The indigo is well rubbed into a fine paste with water or lye; it is then stirred into a vat of hot water, and newly slacked lime added; a solution of green vitriol is then stirred into the preparation. The quantities employed are one pound of indigo, four pounds of lime, and three pounds of copperas. The dyeing vat is separate, and furnished with the resulting solution, which contains deoxydized indigo of a reddish yellow colour. There is a precipitate left in the preparing vat of sulphate of lime, lime mixed with indigo, brown, and some blue, and peroxide of iron.

In using this cold vat, cotton and linen are to be first boiled in a weak alkaline lye, and the cloth, whether cotton, wool, or silk, is to be merely dipped without stirring, and allowed to remain from eight to ten minutes; they are hung to drain over the vat; they are then to be exposed to the air to acquire a blue colour, and dipped until the proper tint is obtained. When suitably coloured, they must be plunged into a sour bath of very dilute sulphuric or muriatic acid to remove the lime, and finally rinsed in running water.

Boussingault is of opinion that the dye-stuff might be prepared in the beginning from the mash-vat by this process with great advantage. Numerous products obtained by the action of re-agents on indigo are known in chemistry, but are of little importance to us.

INDUCTION. The process of arriving at generalizations, or laws, by a judicious investigation of numerous facts. In electricity, it is the influence one electrified body exerts on another, whereby its nearest surface is made to exhibit a kind of electricity differing from that of the excited substance.

INDUMENTUM. The coating of feathers on birds.

INDUSIÆ. The cases of certain water insects; they are silicious, calcareous, or ferruginous.

INDUSIUM. The thin membrane covering the fruit of some ferns.

INDUVIÆ. Organized remains; the withered leaves of monocotyledonous trees, &c.

INERMIS. Unarmed; without spines or prickles.

INERT VEGETABLE MATTER. Peat, tan, &c., which does not readily ferment; mixture with dung, lime, or ashes reduces it.

INERTIA. The indifference of matter to rest or motion

INFIELD. Under improved tillage

and rotations, as distinguished from outfield lands.

INFLAMMATION. An unnatural increase of circulation, blood, and heat in any part. It originates in irritation, colds, contagion, and unhealthy conditions of the nervous system, and may attack any part. It begins with dryness, heat, pain, and tension, which is succeeded by increased vascularity, swelling, and secretion, and terminates naturally by resolution to the primary states, by the adhesion of parts or the formation of pus, ulceration, mortification, and death of the part.

If the animal be vigorous, it is to be treated by bleeding, purging, blisters, and cooling applications. But the inflammations of weakly animals, especially when arising from contagion and ending in ulcerations and gangrene, is to be treated by stimulants and tonics, of which carbonate of ammonia (*sal volatile*) and bark are the best.

INFLATED. Distended like a full bladder, as the carpels of some plants.

INFLEXED. Bent inward.

INFLECTION. In optics, the same as diffraction.

INFLORESCENCE. The grouping of flowers on the stems of plants; the principal forms are the spike, raceme, corymb, umbel, panicle, thyrsus, catkin, capitulum.

INFLUENZA. An epidemic cold, with sore throat and fever, prevailing in some springs.

INFUNDIBULIFORM. Shaped like a funnel.

INFUSION. A liquor obtained by macerating herbs, &c., in hot or cold water.

INFUSORIA. The minute animalcules of infusions and stagnant waters; some possess a mineral casing; and the remains of innumerable myriads are found in rocks, such as tripoli, polirsheifer; hence termed *infusorial*, or *infusory rocks* or formations.

INGLUVIES. The crop of birds.

INGUINAL. Connected with the groin (*inguen*).

INK. To make black ink of the best quality, take 12 parts gall-nuts, 5 of green vitriol, and 5 of gum; the galls are to be well pounded and boiled, and the other ingredients afterward added; 1 gallon of water is used for every pound of galls. Oak bark, logwood, and other substances are often used in place of the galls: the quantity must be two or three times greater.

The indelible ink, for marking linen, is a solution of nitrate of silver (lunar caustic). It is used with a clean pen on a place previously soaked with a little salt; the marking is to be exposed to light to blacken. It is removable by chlorine and ammonia.

Blue ink is a patent solution of Prussian blue in oxalic acid and water; gum is added to make it adhere to paper; it is perishable, and easily dissolved.

INJECTION. In farriery, a fluid medicine thrown into any cavity of the body by a squirt or syringe.

INNER BARK. The liber of botanists, bass.

INNOMINATUM BONE. The bone of the buttock; aitch, or adze bone.

INOCULATION. The introduction under the skin of animals of a particular poison, fluid, or virus, to produce a specific disease, as smallpox. Budding and the transfer of grass turfs are also called inoculation by farmers.

INORGANIC. Not organic or destructible by heat, as the ashes of plants, minerals, &c.

INOSCULATION. The union of the extremities of veins and arteries.

INSECTIVOROUS. Birds, animals, or reptiles that prey on insects.

INSECTS. The following brief sketch of Entomology is chiefly by Mr. Swainson, from Loudon's Encyclopædia:

"Insects, above all other animals, are by far the most injurious to the agriculturist, not only from their numbers, but from their attacking the produce of the earth in all its stages of growth and maturity.

"Insects are distinguished from

worms (*Vermes*, Lin.) by always having feet in their perfect state, as the beetle, butterfly, &c. Worms crawl upon their bellies, and have no feet, as the earth-worm, slug, snail, &c. The generality of insects have only six feet (*Hexapods*); but some few, generally called by this name, have a great many, as the wood-louse, centipede, &c.

"Nearly all insects are oviparous; that is, produced from an egg. These eggs are seldom found singly. Those, of some species, are hatched in a few days, while others remain during the winter, and the young do not come forth until the season at which the leaves of the plants upon which they feed begin to expand.

"The second state of the insect is called the eruca, or larva. Caterpillars are those larvæ which are exposed, and feed upon leaves and plants. The larvæ of beetles usually live in the earth, in the trunks of trees, or in the substance upon which they feed; they are generally of a whitish colour, thick and clumsy in form, and are called grubs; while the name of maggots is usually given to the larvæ of flies, bees, ants, &c., all of which live in the same confined state as those of beetles. It is in this stage of existence that insects are most voracious, and, consequently, most destructive to plants.

"When the larva has attained to its full size, it changes into the pupa or chrysalis state. This is done in different situations, according to the tribes to which they belong. The chrysalis of butterflies are naked, and are either suspended or attached to trees, branches, walls, &c. Those of moths are either concealed in a case, like the cocoon of the silkworm, or the caterpillar undergoes its change in the earth. The period in which insects remain in this state varies according to the species; but in most cases they are inactive and torpid.

"The *imago*, or perfect insect, is produced from the chrysalis, and is the only state in which all its parts and members are fully developed. The appearance and economy of perfect insects, in general, is totally different from those of the larvæ and pupæ, and it is only in its final stage of existence that the species can be ascertained. With the exception of such insects as form the aptera of Linnæus, all others are furnished with wings, either four or two in number. Some few exceptions, however, occur to this rule; the female of the glow-worm and of some few moths are apterous, while many beetles (although furnished with hard winged cases) are destitute of real wings. The body is divided into a head, thorax or chest, and abdomen: the head sustains a pair of antennæ, resembling horns, two eyes, often very compound; the parts of the mouth are a labium, labrum, mandibles, and maxillæ, or jaws; to the latter are attached the organs of feeling (*palpi*).

"The duration of insects is extremely variable: the greatest proportion appear to be annuals, emerging from the egg and passing through the three stages of their existence within the space of a year. But there are a great number of species, particularly among the beetles, which pass three, and even four years in the caterpillar state; and instances are on record of beetles remaining in timber from ten to fifteen years. The greatest proportion of moths are biennial, passing the winter in the chrysalis state, and closing their existence in the succeeding summer. The transitory life of the ephemera is proverbial; the perfect insect, indeed, exists but for a day, and seems born only to continue its species, yet in the larva state it enjoys a life of one, two, or even three years.

"*Arrangement or Classification of Insects.*—All insects may be divided into two groups: 1. *Apterous insects*, having either no metamorphosis, or only that kind of it the tendency of which is confined to the increase of the number of feet: these, as their name implies, are destitute of wings. 2. *True insects*, or those whose metamorphosis has a tendency to give wings to the perfect or image state, but never more than six feet.

"True insects are again divisible into two primary groups: the first of these are organized for mastication in their perfect state, and the second are organized for suction alone. Each of these divisions, according to the system of Macleay, contains five separate orders, the principal characters of which we shall endeavour to make intelligible in common language.

"The *Mandibulata*, or masticating insects, are furnished with jaws (*trophi*) of a horny or membranaceous substance, infinitely diversified in their form and structure. They are divided into the following orders:

"1. *Trichoptera.*—The wings are four, soft, and generally transparent; the upper pair slightly hairy, and the lower folded when at rest. The insects of this order are comparatively few. The caddy, or cadis worm, is the larva of the spring fly (*Phryganea*), and lives in the water, concealed within a tube of its own construction.

"2. *Hymenoptera.*—The wings are four, clear and transparent. The tarsus (or outer division of the foot) is composed of five joints, and the body is armed with a sting. The bee, the ant, and the wasp are familiar examples.

"3. *Coleoptera.* This well-defined and most extensive order comprehends all insects known by the name of beetles. They have two wings, concealed beneath a pair of hard wing-cases, which meet close together in a straight line down the back. There are many tribes of these insects, which, both in their larva and perfect state, are extensively injurious to man.

"4. *Orthoptera.*— The true wings are but two, very large when expanded, and folded lengthwise when at rest. They are covered, either partially or wholly, by two wing-cases of a thin, tough, and rather opaque substance, somewhat resembling parchment, and reticulated with small nerves. The leading characters of this order are exemplified in the Blatta, or cockroach, the pest of tropical countries, and frequently troublesome in our kitchens and larders.

"5. *Neuroptera.*—The wings, with very few exceptions, are four in number, clear, transparent, and reticulated with numerous areolets, or irregularly square divisions; the tail of the female is not armed with a sting. Few, if any of these insects may be considered as injurious: some are, indeed, beneficial; as, from their predatory habits, they attack and devour a vast number of smaller insects. This is more particularly the habit of the green dragon fly (*Agrion virgo*), which every one may see, during summer, hovering over ponds, and flying about like a hawk in search of its prey. The ephemera, or day-fly, likewise belongs to this order.

"The *Haustellata*, or suctorial insects, likewise contain five orders. Although apparently destitute of jaws, there is every reason to believe that the rudiments of the masticating organs exist in these insects, but that they are so slightly developed as to be totally useless, and only discoverable under a very strong magnifier. The suctorial insects in their larva state are mostly furnished with strong and well-defined jaws, and feed voraciously upon animal and vegetable bodies; yet, from the perfect insect being supported by suction alone, it is obvious that in this state they can do no injury to the agriculturist. The orders into which they have been divided are these:

"1. *Lepidoptera.*—The wings are four, thin, membranaceous, and covered with a fine powdery substance, which, by the magnifying glass, is shown to consist of minute scales, lying one upon another, like those on fishes. The butterfly and moth tribes are familiar to every one as well-known examples of these insects, the larva of which are called caterpillars.

"2. *Diptera.*—The wings are two, clear and transparent, like those of the common house-fly. This order is very numerous, and contains many insects which are injurious to vegetables as larvæ, and troublesome to man in a winged state, as the gnat (*Culex*), whane-fly (*Tabanus*), crane-fly (*Tipula*).

"3. *Aptera.*—Entomologists of the last century arranged all insects without wings under this order; but it is now restricted, by Latreille and Macleay, to such only as have a bivalve articulated sheath to their mouth or rostrum, and no wings, as in the case of the common flea.

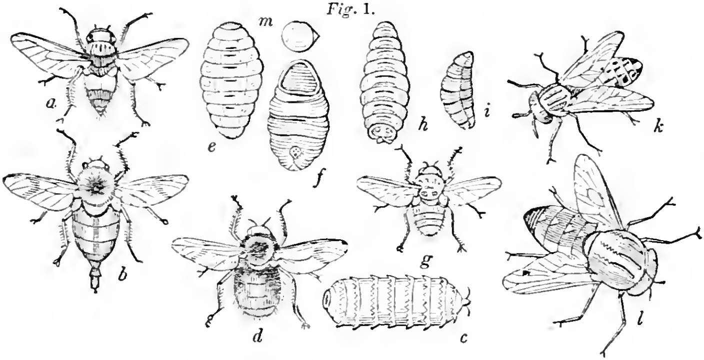
"4. *Hemiptera.*—Insects of this order are furnished with two folded wings, covered by wing-cases, also crossing over each other, of a semicorneous substance, and which are likewise useful as organs of flight. The tarsi are composed of three, two, or sometimes only of one joint, and the body is much flattened. The various insects commonly called field-bugs, which emit a strong and disagreeable smell when handled, are all arranged under this order.

"5. *Homoptera.*—These insects have a great resemblance to the last; but the body, instead of being depressed and flat, is convex and thick; the wings, also, instead of being folded over each other, are deflexed, and embrace the sides of the body.

"The different orders of insects we have now enumerated are connected by others of an inferior extent, and which are called osculent orders. But a description of these is not essential to our present purpose, as they do not contain any decidedly injurious insects.

"*Insects injurious to Live Stock.—The horse.* The principal foes to this animal are the horse-bee (*Œstrus equi*) and gadfly (*Œ. hæmorrhoidalis*). The first deposites its eggs on such parts of the body as are liable to be licked by the tongue, and the animal thus conveys its enemy into its stomach; the young larvæ are there nourished, and become whitish rough maggots (*Fig.* 1, *c*), which are known by the name of bots. They attain their full

Fig. 1.



size about the latter end of May, and are voided about the end of June. On dropping to the ground, they find out some convenient retreat, where they change into a chrysalis, and in six or seven weeks the fly appears. The female (*b*) is distinguished from the male (*a*) by the lengthened shape of her body. The inside of the knee is chiefly selected for depositing her eggs, which will frequently amount to four or five hundred on one horse. The other species (*Œ. hæmorrhoidalis*, Lin.) is still more troublesome; it deposites its eggs upon the lips, and causes excessive and distressing uneasiness to the animal. The prevention of bots belongs to the farmer, the cure to the veterinary surgeon. The first may be effected by watching the animal at the season when the female deposites her eggs (usually in August and September), and should the horse appear much agitated in its pasture, there will be good reason to suspect it has been attacked by the fly; the eggs may then be removed by the brush and curryeomb, or by a pair of scissors. When the disease is certain, one of the best methods to destroy the insect is to fasten a bag net on the horse, for the purpose of catching the excrement, as well as the full-fed larvæ. By throwing the dung every morning into a deep pit, any larvæ that may be enclosed in it will thus be prevented from working their way to the surface when their last transformation is about to take place, and their death will cut off a numerous progeny. There are other dipterous insects which feed upon the blood both of horses and cattle; the most formidable of these are the horse-flies (*Tabani*, *k*, *l*); others, much smaller (*Stomoxys calcitrans*), assail him in every situation during summer, and dart their long probosces into his legs and belly. But none are more trying to him than the forest fly (*Hippobosca equina*, L.), which runs sidewise or backward, like a crab, and shelters itself in those parts least covered by hair: it may, however, be caught by the hand when the animal is in his stall; but its substance is so hard, that it can only be destroyed by rolling it between the finger and thumb.

"Horned cattle are likewise subject to the attacks of a peculiar species of gadfly (*Œ. bovis*, *d*, *e*, *f*), which causes them great terror and distress. The larva (*e*) is smooth and fat, and the chrysalis (*f*) opens by a lid (*m*) when the insect (*d*) emerges from it. The herdsman may know when this insect appears among his flocks, by the agitation they exhibit; the whole herd, with their tails erect, or carried in some grotesque attitude, gallop about and utter loud lowings. When oxen are employed in agriculture, the attack of this fly is often attended with danger, as they become quite unmanageable, and, whether in harness or yoked to the plough, will run directly forward. Their harness at this season should, therefore, be so constructed as to be easily loosened. The eggs are deposited *within* the skin of the animal, and in a wound made by a tube resembling an auger, with which the female is provided. These flies only attack young and healthy subjects; but, independently of the terror they create, do not appear to occasion any material injury.

"Sheep are also infested by another species of gadfly (*Œ. ovis*, L., *g*, *h*, *i*), which deposites its eggs in the inner margin of their nostrils. The moment the fly touches this part of the sheep they shake their heads, and strike the ground violently with their fore feet; at the same time, holding their noses close to the earth, they run away, looking about them on every side, to see if the fly pursues: they will sometimes crowd together in a rut or dusty road, with their noses close to the ground. The larvæ (*i*) are white, flat on one side and convex on the other; they inhabit the cavities of the maxillary sinuses, and crawl, when the animal is dead, into those of the horns and frontal sinuses; when full grown, they fall through the nostrils, and change to the chrysalis (*h*), which produces the fly (*g*) in about two months. Swine, pigeons, and all kinds of poultry are subject to fleas and lice of various kinds, but never to such a degree as to occasion death.

"Fish, in their young or fry state, are the food of the larvæ of water-beetles (*Dytisci*). These insects are frequently seen in great numbers in ponds; they may be caught by a hand net (made of very small meshes), inserted beneath the insect, as he reposes (with his head downward) on the surface, and then suddenly drawn upward.

"*Insects injurious to Vegetables.*—The ravages of insects upon plants commence from the time that the seed is committed to the ground, and continue until the produce is gathered into the barn. We have noticed the destructive insects which are, in a great degree, peculiar to certain plants, as wheat, barley, &c., in a general way; we shall now enumerate those that infest the grains, clover, pastures, cabbages, and fruits, plantations, as well as those universal destroyers of *all* vegetables, the wire-worm, the plant lice, and the different species of crane-fly.

"Wheat, in every state, is subject to many insect depredators. Mr. Marsham describes a small grub which eats into the young plant about an inch below its surface, devours the central part, and thus causes its immediate death. At a later period this grain is attacked by a fly nearly related to the *Mosillus arcuatus* of Latreille. It makes a lodgement in the heart of the principal stem just above the root, which stem it invariably destroys, giving the crop at first a most unpromising appearance. When the wheat blossoms, it becomes exposed to the attack of a small orange-coloured gnat, which deposites its eggs in the centre of the flower. The weevil is destructive to wheat when in the granary, where it feeds both in the larva and perfect state.

"Rye is subject to the attacks of a small fly (*Musca pumilionis*), which introduces its eggs into the heart of the shoots, and occasions a loss of from eight to fourteen plants in a square of two feet. No remedy has yet been proposed for this pest, which, if not extensive, may be checked by plucking the injured ears and burning them.

"Barley, besides other insect foes, has one peculiar to itself, in the shape of a small moth (*Tinea hordei*, K.). This fly deposites from 20 to 30 eggs on a single grain; when hatched, each of the larvæ disperses, and, selecting a grain for itself, enters from without, and lies totally concealed. Should these moths be observed in a granary, the injury may be stopped by carefully covering the grain, leaving a few handfuls exposed; upon these the moths will deposite their eggs, and by roasting or destroying this small quantity, the rest may be saved from infection.

"Oats are subject to few diseases; but, like all other grain, the plants are liable to be destroyed by that universal devastator, the wire-worm, of which a more particular account will be found in treating of insects universally injurious to vegetables. The chinch bug is often very injurious in the South.

"The diseases of peas are mildew and blight, but these are only occasional; its insect enemies, however, are formidable; the principal of these is the plant louse (*Aphis*), one species of which is peculiar to this plant. Beans are exposed to the same injury from another species of aphis of a black colour, which begins at the top of the plant, and multiplies downward. In both cases the most effectual remedy is to top the plants at an early period of the infection, and burn the parts so gathered; this plan is likewise advantageous, as it improves both the quality and quantity of the crop. The earlier pease are sown, the better chance they stand of escaping this pest; or if a small quantity of quicklime is sprinkled upon them when they are a few inches high, experience has shown that the plants remain uninjured, while the aphis is totally destroyed.

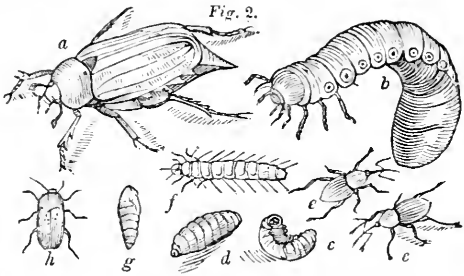
"Turnips are subject to several peculiar diseases, and are the food of many noxious insects. On the first appearance of the leaves, a whole host of little jumping beetles (*Haltica nemorum*), called by farmers the fly and blackjack, attack and devour them, so that the land is often obliged to be resown. Nearly as much damage is sometimes caused by a little weevil (*Curculio contractus*, Marsham), which in the same manner pierces a hole in the cuticle: watering with limewater, &c., may serve to check both these evils.

"The hop is liable to many diseases caused by insects. When the plants first emerge above the ground, they are infested by a small beetle (*Haltica concinna*), vulgarly called the flea. In a more advanced state the tops and branches are devoured by the hop aphis, known to some by the name of the green fly, while at the same period the roots are subject to the attack of the caterpillar of a singular species of moth, named by collectors the ghost moth.

"Clover is very subject to be injured by a very small weevil (*Apion* *flavifemoratum*, K.), which at all seasons feeds upon the seed of the purple clover, while another species of the same tribe (*A. flavipes*) devours that of the white or Dutch clover; the injury, unfortunately, cannot be known while the plants are growing, as they have then every appearance of being perfectly healthy. The young shoots of the purple clover are often devoured by jumping beetles (*Haltica*, F.).

"Pastures in general are often destroyed, to a very great extent, by the larva or grub of the cockchafer (*Fig.* 2, *a*).

Fig. 2.

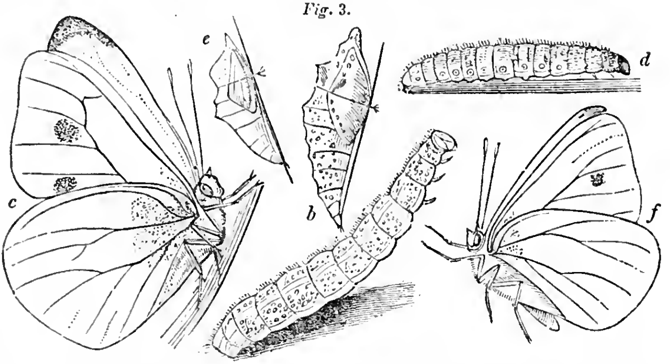


"The ravages of the larvæ are even exceeded by those of the perfect insect, which sometimes appears in the country in prodigious multitudes, and, like a flight of locusts, devour every green thing on the face of the earth. The eggs of this terrible devastator are white, and are deposited in the ground, where they soon change into a soft whitish grub with a red head, and about an inch and a half long (*b*). In this state it continues four years, during which time it commits most destructive ravages on the roots, not only of grass, but of all other plants and young trees. Whole acres of the richest pastures are thus rendered unproductive; all verdure is lost, and the turf will roll up almost with as much ease as if it had been cut with a spade. The whole of this injury being carried on under ground, admits neither of preventive nor palliative measures; but the destruction to be expected from the perfect insect may yet be prevented. If the dried and withered turf is now removed, the soil underneath will appear turned into a soft mould for about an inch in depth, like the bed of a garden; in this will be found the grubs, lying on their backs in a curved position, and vast quantities may be gathered and given to pigs and poultry. When full grown, the larvæ dig in the earth to the almost incredible depth of five or six feet, spin a smooth case, and then change into a chrysalis. In this inactive form they remain until the following spring.

"The perfect insect or beetle then comes from the ground, and commences an immediate attack upon the leaves of all trees. Their numbers are sometimes immense. The best, and, indeed, the only effectual remedy for the destruction of the perfect insect, is to shake the trees or bushes at noon, when they are either asleep, or in a state of stupor, and then to sweep or gather them up. One person in this way has been known to capture a thousand in a day, which, on a moderate calculation, prevented no less than one hundred thousand eggs from being laid. Some judicious farmers plough the ground when they have reason to think it is infested by the grub, and this is generally indicated by the rooks attempting to reach them. They are also greedily devoured by crows and jays, whose sole employment, for nearly three months in the spring of the year, is to search for insects of this sort; and the destruction they cause among them is above all calculation.

"Cabbages, and other esculent vegetables, are well known to be greatly injured by the caterpillars of two different kinds of white butterflies (*Fig.* 3); one of these (*Pieris brassicæ*, *c*) is much larger than the other;

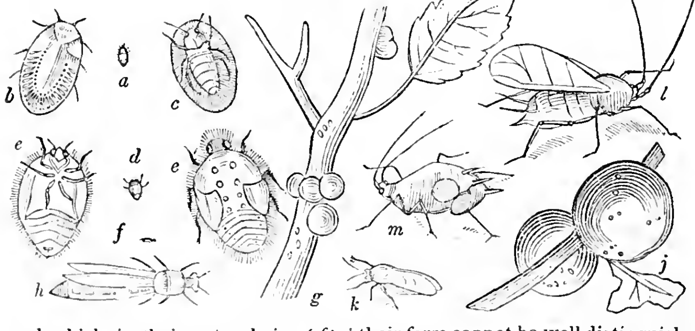
Fig. 3.



the caterpillar is pale yellow, with black spots (*a*): when full fed, it shelters itself on walls, pales, or trunks of trees, and changes into the chrysalis state (*b*), in which it still preserves the same cast of colouring. The perfect insect (*c*) appears early in spring, and continues until the end of summer. The other species of caterpillar is green (*d*); the chrysalis (*e*) is of the same colour; and the butterfly (*f*) is produced about the same time as the preceding. Hand-picking the larva, and searching for the chrysalis, are the only plans of destruction, either for these or the gooseberry and currant caterpillars.

"Fruit-trees of all kinds, and their produce, are attacked and devoured by a great variety of insects. We shall, however, advert to those curious, minute insects (*Thrips Physapus*, *Fig.* 4, *f*, *h*) so often seen in flowers and blossoms during the spring,

Fig. 4.



and which, in their natural size (*f*), appear like short black lines. Nearly all fruit-trees are liable to considerable injury from different species of *Coccus*, or cochineal insects; they are mostly so small (*Fig.* 4, *a*, *d*), that their form cannot be well distinguished without the aid of a magnifying glass; many of them resemble small scales, or scabs, fixed on the bark and shoots. One is entirely of a brown colour (*Coccus persicorum*, *a*): when magnified (*b*), it somewhat resembles the tortoise beetle (*Cassida*, L.), the legs and head being only discernible when the insect is turned on its back (*c*). Another (*C. fol. quercus*, *d*, *e*, *e*) does much injury to the oak; while the *C. fagi* attacks the twigs of the beech (*g*), and causes small round excrescences to appear; these are, however, very different from the gall-apples of the oak (*j*), which are often found of considerable size, and are produced by the *Cynips quercus folii*, L. (*k*), or oak-gall-fly, and always contain either the larva or imperfect insect. The weevils (*Curculionidæ*) form an exceedingly numerous family, subsisting principally upon fruit, seed, and grain; one of these is the nut-weevil (*C. nucium*, *Fig.* 2, *c*, *e*), the larvæ of which (*c*, *d*) are the maggots so frequently found in this fruit.

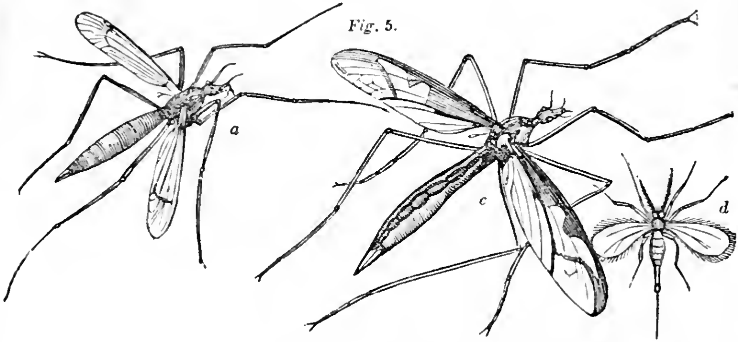
"The *Aphides*, or plant lice, next to locusts, are the most universal devastators; almost every plant has its peculiar species; their fecundity is so prodigious, that Beaumé has calculated that in five generations one aphis may be the progenitor of 5,904,900,000 descendants; and it is supposed that in one year there may be twenty generations! Those which attack the different kinds of grain seldom multiply so fast as to be very injurious; but those peculiar to pulse increase rapidly, and take such possession that the plants are greatly injured, and frequently destroyed, before the seeds are matured.

"These insects are equally injurious in their winged (*Fig.* 4, *l*, magnified) and in their larva, or apterous state (*m*, magnified); they are a favourite food of sparrows and other birds, who destroy numbers; they are likewise exposed to other deadly and cruel enemies; one of these is a small hymenopterous insect, which deposites its egg in the body. But the most inveterate and destructive foe to the plant lice is the lady-bird, or lady-cow (*Coccinella*, Lin.), which, in its larva state, feeds entirely upon these insects; and the havoc made among them may be conceived, from the myriads upon myriads of these little creatures which are usually seen in years when the plant louse abounds; every one, probably, destroying tens of thousands. On this account, the lady-bird is the greatest friend to the gardener and farmer; and could there be any method devised of increasing these useful insects at will, our hot-houses, gardens, fields, and hop plantations would soon be cleared from the ravages of plant lice. The larvæ of several bee-like flies (*Syrphus*) are no less useful in this respect. Their form very much resembles that of the leech, having no apparent head. Some species are green, with a white stripe down the middle; others brown, variegated with darker shades. They are always found upon those plants most infected by aphides, upon which they solely depend for nourishment; hence they become most beneficial, and should on no account be destroyed. As palliative measures, the application of powdered quicklime may be resorted to, or the infected parts pruned off before the insects greatly multiply.

"The wire-worm is a name that has been given, without discrimination, to the larvæ, or grubs, of various insects, totally different from each other; hence it is, that much confusion and contradiction will be found respecting it in agricultural books The true wire-worm is the grub of a small beetle (*Elater segetis*), and it derives its name from its slender form and uncommon hardness. It lives in the larva state nearly five years, during which time it is supported by devouring the roots of wheat, rye, oats, and grass, which it attacks indiscriminately, and causes annually a large diminution of produce; it abounds chiefly in newly broken-up land, and is particularly destructive in gardens recently converted from pasture land. In the larva state it may be decoyed by offering it more tempting food; but no method has yet been devised for destroying the perfect insect.

"The grub is a general name for several larvæ of crane flies (*Tipulidæ*), called by the country people long legs, or gaffer long legs

Fig. 5.



"One of the most destructive among these insects to the roots of grass and grain is the *Tipula oleracea*. The larva is said, by some authors, merely to loosen the roots by burrowing among them; but others assert that it likewise feeds upon the fibres. No effectual remedy has yet been discovered for this evil; and Steckney observes, that the insect is not killed by lime, even when applied in much larger doses than usual.

"There are several other species of a large size, as the *Tipula crocata* (*Fig.* 5, *a*), and *Tipula rivosa* (*c*) which, in a less degree, are also injurious to such lands as are moist and humid.

"Another minute species is particularly destructive, and is generally known as the wheat fly (*Tipula* or *Cecidomyia tritici*, *d*, magnified); its history and economy have been ably investigated by Mr. Marsham and Mr. Kirby. The injury first appears in the ear, several of which, on being opened, will be found to contain an orange-coloured powder; in this are concealed very minute larvæ, which, on being magnified, are seen to be thick at one end, extending and contracting themselves at pleasure, and frequently jumping half an inch at one spring: they take their station in the longitudinal furrow of the grain, and, by sucking its milky juice, cause it to shrink up, and become what the farmers call *pungled:* the last sown wheat always appears the most infected. In the beginning of June the perfect insect (*d*) may be seen in innumerable multitudes, flying in the evening in all directions over the corn-fields; but during the day not one is to be perceived. The female lays her eggs by means of a retractile tube, which encloses a very long and acute sting resembling a hair; but this can only be distinctly seen when the insect is magnified. The wheat fly would soon become a formidable enemy to mankind, were not its race exposed to an inveterate foe, scarcely larger than themselves; this is the *Ichneumon Tipulæ*, the female of which carefully searches out the grubs of the wheat fly, and deposites in each one of her eggs; these are hatched, and ultimately the larva devours the body which gave it life. One ichneumon will thus cause the death of many dozens, and prevent the future multiplication of thousands. The only palliative that has been recommended for stopping the progress of this insect originated in Mr. Kirby: this naturalist thinks much benefit would be derived by fumigating the corn with tobacco and sulphur, when the wind is in a favourable quarter: this must be done as soon as the ear begins to shoot from the leafy stalk.—See *Wheat Insects*.

"*Insects injurious to Food, Clothing, &c.*—The cockroach is called by some the black beetle (*Blatta orientalis*). Like most of its tribe, it shuns the light, both natural and artificial. It is very abundant, and indiscriminately devours bread, meat, flour, and even clothes. The young are contained in a singular horny case, which is divided into a number of transverse partitions or chambers; it is rather flattened, and quite smooth, except one side, which is toothed. The larva and pupa are both without wings, and generally larger than the perfect insect.

"The house-cricket (*Gryllus domesticus*, Lin.) is sometimes abundant in farm-houses. It devours every kind of food, and is often found drowned in pans of water, milk, and other fluids; it is said it will even attack stockings, or linen hung out to dry. Another species is peculiar to pastures, which, in conjunction with the mole cricket, feeds only upon roots.

"The bacon-grub (*Dermestes lardarius*, Lin.) is a great pest to the winter provisions of the farmer, devouring hams, bacon, and all sorts of dried meats. This is principally done when the insect is in its larva or grub state (*Fig.* 2, *f*). When full fed it becomes a chrysalis (*g*), which ultimately changes into a small beetle (*h*) about a third of an inch long, of a dusky brown colour, with the upper half of the wing-cases whitish or ash coloured, marked with black specks. The grub, from lying concealed in the meat, cannot be effectually removed; but by watching the time when the perfect insects appear, they may then be destroyed, and a recurrence of the evil in a great measure prevented.

"Woollen clothing of every description, furs, are liable to be devoured by the larvæ, or caterpillars, of no less than five distinct species of small moths. Most of these enclose themselves in little tubular cases of a silky texture, and are so well disguised externally by fragments of the stuff they feed upon as often to escape immediate observation. As a preventive, tobacco leaves may be laid between the folds of garments (in drawers) which are not often used. If there is reason to fear the moths are in the house, these garments should be frequently opened, and aired by exposing them to the sun. When furs of any kind are laid by for the summer, they may either be sprinkled with snuff or camphor, and Russia leather or tobacco leaves put in the drawer or box. Should the moth actually have got into furs, the only way of checking the evil is to put them into an oven moderately heated, and by keeping them in this situation a quarter of an hour, every grub will be effectually killed; the degree of heat may be ascertained, in the first instance, by putting in some common feathers, which should come out uninjured.

"*Means of subduing Insects.*—The operations for destroying insects, or counteracting their injurious effects, are various, and in most cases must be regulated according to the species. These we have already pointed out in treating upon the insects themselves, or of the particular plants upon which they feed. It only remains to offer such general rules as are more or less applicable to all destructive insects; these are of three kinds, preventives, palliatives, and efficient processes.

"The preventive operations are those of the best culture as relates to the choice of seed or plant, soil, situation, treatment, and climate: the first four are under the control of man, and an attention to them will undoubtedly lessen the risk of injured crops; but as regards weather, neither his foresight nor care can avail anything.

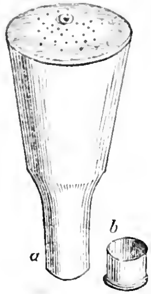
"The palliative operations are numerous; and such as are eminently successful may be considered as efficient, inasmuch as it rarely, if ever, happens that any insect can be exterminated, even from one district; its numbers may be diminished, but the species will still remain, although in such small numbers that its operations may escape notice. Most insects will be injured, and in part destroyed by artificial bad weather, such as excessive waterings, stormy application of water with a syringe, and shaking the tree or plant: many will thus be bruised, and others that are shaken to the ground can be destroyed. Insects may be farther injured by watering the plants upon which they feed, either with tobacco or lime-water, solution of whale-oil soap, or by scattering upon the leaves powdered quicklime, soot, ashes, salt, &c. The smell of tar is particularly offensive to all insects, and the effects produced by the fumes of tobacco, sulphur, urine, &c., are well known. Hot water may be applied with much advantage. Water heated to 120 or 130 degrees will not injure plants whose leaves are fully expanded, and it may be increased to 200 for such as are without leaves.

"Insects may be destroyed in a much more effectual manner by enticement, or placing in their way other food as a trap. The late Sir Joseph Banks has the merit of having recommended and made known this most efficient method. It simply consists in cutting slices of potatoes or turnips, sticking them upon skewers, and then burying them near the seeds sown: the vermin will collect upon them during night, and by examining them every morning, vast numbers may be destroyed; this plan has been very advantageously tried with the wire-worm, and, no doubt, would be equally beneficial in clearing all crops that are attacked by under-ground feeders. Mr. Kirby states 'that it was very successfully employed to preserve some wheat-fields from the ravages of a small, gray slug, which threatened to demolish the plant. Having heard that turnips had been used with success to entice the slugs from wheat, he caused a sufficient quantity to dress eight acres to be got together, and then, the tops being divided and the turnips sliced, he directed the pieces to be laid separately, dressing two stetches with them, and omitting two alternately, till the whole field of eight acres was gone over. On the following morning he employed two women to examine and free from the slugs (which they did into a measure) the tops and slices; and when cleared, they were laid upon those stetches that had been omitted the day before. It was observed invariably, that in the stetches dressed with the turnips no slugs were to be found upon the wheat, or crawling upon the land, though they abounded upon the turnips; while, on the undressed stetches, they were to be seen in great numbers both on the wheat and on the land. The quantity of slugs thus collected was near a bushel.

"*The turnip-net* is the most successful expedient that has yet been thought of for the capture and destruction of the little beetles, called by farmers the black jack, and by hop-growers the flea. It consists of two pieces of stout wood, the ends of which, at one extremity, are fixed into a handle in a forked direction; the other ends are left thick and curved upward, for the purpose of passing the instrument smoothly and easily over the surface of the ground; towards this end, the sticks are connected by a cross-bar formed by a thin iron rod, that may be taken on and off at pleasure; these three sides constitute the frame work for supporting a long and ample bag, made of strong, glazed calico. The method of using it is by the operator shoving it before him on the ground, over the tops of the turnips or other plants; by this means the insects that are upon the leaves fall into the bag, which may be occasionally shaken during the process, so as to bring them to the bottom (which is made narrow), where they will remain. Vast quantities of insects, which, from their smallness and agility, defy hand-picking, will be thus captured. The turnip-net may be made either large or small; perhaps two feet and a half for the side sticks is the best length, it being obvious that the wider they are apart, the greater space will be brushed at once.

"The lime-duster (*Fig.* 6) is a recent invention by Mr. Samuel Curtis, and has been used by him with great success in throwing pulverized quicklime over apple-trees infected by caterpillars and other insects. His orchard, containing many thousand

Fig. 6.



fruit-trees, and occupying fifty acres, had been for many years completely divested of most of their foliage and young fruit in the spring months. Washing the stems and branches with lime and water (as might have been expected) was found ineffectual for the destruction of insects which feed only on the young buds and leaves. The instrument in question consists of a canister twelve inches long, seven inches wide at its broadest, and four inches on its narrowest part; the handle (*a*) is five inches and a half long. The top of the handle is fitted with a cap (*b*), which is put on when the lime is to be thrown on low trees; but when high trees are to be operated upon the cap is removed, and a pole of sufficient length to reach the height required is inserted into the handle. Quicklime pulverized (and often sifted through a fine sieve) is put into the canister, and shaken over the young foliage just as it was expanding. The time for doing this is in the dew of the morning, or whenever the leaves are damp; and if there should be a gentle breeze sufficient to carry the dust obliquely through the head of each tree, it is the more quickly performed. Under favourable circumstances of this nature, Mr. Curtis says, 'I found that three men, provided with the powder in a large box on a light wheelbarrow, could dress from two to three thousand trees in a day: when the wind changed, I had the trees dressed on the other side. Although used ever so freely, no person need fear any injury, from the caustic quality of the lime, on the most delicate and fresh expanded foliage; it is only prejudicial to insects *of all kinds*, and to dead vegetable matter.' (*Hort. Trans.*, vol. vi., pt. 2, page 124). We know not whether the lime-duster has ever been tried upon hop plantations infected by the green fly or plant louse; but it appears to us equally well adapted to effect a great destruction among those insects.

" Grain of all descriptions that is infected by weevils, or by the grubs of other insects, should be spread in the sun, and frequently turned: the warmth will bring the animals out of the grain, and considerable numbers may be destroyed. It has been said that they may be kept away by strewing boughs of elder or branches of henbane among the grain, but this wants confirmation. It should be steeped in strong brine.

" Hand-picking, independent of the foregoing methods, is too tedious and too ineffectual for general adoption in large crops, but is probably the best that can be resorted to in gardens or small enclosures. In this way the different esculent vegetables, and the common and low kinds of fruit-trees, as currants, gooseberries, &c., may be cleared of a vast number of caterpillars.

" Catching the perfect insect is undoubtedly the most certain plan for preventing a return of the same injury the following year, for the death of one female will cut off a generation of a hundred larvæ; but from the difficulty that attends an extensive adoption of this plan, it is not likely to be much attended to.

" *Worm-like Animals injurious to Agriculture.*—Of worms (*Vermes*, L.), generally so called, there are but few which may be considered as injurious to agriculture. The principal of these are the various species of slug (*Arion*, F., *Limax*, L.) and the large and small snails (*Helix hortensis* and *nemoralis*, L.), mostly found in garden plantations. The earth or dew worm (*Lumbricus terrestris*, L.), unless existing in great numbers on a single spot, cannot be ranked among injurious animals, notwithstanding the prejudices of farmers and gardeners against them. Without worms, the earth would soon become hard, cold, incapable of receiving moisture, or of giving nourishment to roots: they are, in fact, the great promoters of vegetation, by boring, perforating, and loosening the soil beneath, and by manuring it above with their excrement, which is thrown up into lumps called worm casts. The wire-worm does not belong to this tribe, but is the larva of a small beetle already noticed.

"Worms of the slug kind are without shells. There are several species, all of which subsist on leaves, roots, and vegetables. The most common is the *Limax agrestis*, of which there are several varieties injurious to the agriculturist and gardener; they devour the young shoots of turnips, wheat, and, indeed, all kinds of grain, frequently to a ruinous extent; their eggs are small, round, of a semipellucid whiteness, and are deposited in the earth. The methods of destroying or eradicating the perfect animal have been already described.

"The shell slug (*Testacellus mangi*) is a native of Teneriffe, remarkable for feeding upon earth worms; and may, therefore, be beneficially introduced into such gardens as are overstocked by that otherwise useful animal. It is readily distinguished from all other slugs by having a thin, oval shell affixed to the hinder part of its body. Slugs in general are easily enticed by cabbage leaves, scattered near such garden vegetables as they appear to injure most.

"Snails are slugs covered by a shell. The two species most prejudicial to cultivated vegetables are the garden snail (*Helix aspersa*, Gm.), and the variegated snail (*Helix nemoralis*); both these seek the same description of food, and are equally injurious as slugs, and, like them, may be enticed by cabbage leaves and other juicy vegetable refuse."

The most important insects are noticed under each plant.

INSERTION. In botany, the direction in which an organ, as the stamens, is attached to the part that sustains it.

INSESSORES (from *insideo, I sit*). Birds which perch on trees. *Perchers*.

INSOLATION. Scorched by the sun.

INSPIRATION. In physiology, the act of inhaling air.

INSTEP OF THE HORSE. The part of the hind leg reaching from the ham to the pastern joint.

INSULATION. In electricity, surrounded by non-conducting substances, as glass, resin.

INTEGERRIMUS. With a perfect edge, or margin, in botany.

INTEGRANT PARTS. The smallest parts of a body, by the union of which the mass is produced.

INTEGUMENT. A membranous covering or expansion. It is used in botany for the coverings of seeds.

INTERCELLULAR SPACES. In botany, the minute spaces existing between the sides of cells. Along these the movement of sap occurs in herbs and the lower plants. In some water plants they are large, to assist natation.

INTERFERENCE OF LIGHT. The effects produced by causing two pencils of light to be reflected or transmitted at very minute intervals or distances from each other, whereby they interfere and produce colours. If the light be homogeneous, they produce bright and black bands.

INTERVAL LANDS. Lands on the margin of rivers. Alluvial lands.

INTERNODE. The space between two knots, leaves, or leaf buds, in stems.

INTESTINALIA. Worms inhabiting the interior of the bodies of animals. Entozoa. Those of the intestines are destroyed by purges and large doses (2 oz.) of oil of turpentine.

INTRADOS. The lower line or curve of an arch.

INTRORSE. Turned inward.

INTUSSUSCEPTION. The folding of one portion of the intestines into another.

INULIN. A variety of starch. It is coloured yellow by iodine. Formula, $C_{24}\ H_{21}\ O_{21}$.—(*Parnel.*)

INUNDATION OF LANDS. Fields are sometimes covered with water in agriculture, especially meadows, and in the cultivation of rice. The water is let in by sluices, and allowed to remain for several days or weeks, and, in meadows, during the whole winter. It kills those weeds which are not aquatic, serves to manure the soil, and, in the case of meadows, advances the grass by some weeks, the water protecting it from frost. The lands should be well drained, or on a porous soil; otherwise the water, sinking, will stagnate, and become injurious; it should be perfectly let out by numerous drains. By this practice, meadows have been rendered fertile without other manure for ages. The sediment deposited is sometimes called *warp*, and the inundation *warping*.

INVERTEBRATE ANIMALS, INVERTEBRATÆ. Animals without an internal skeleton or back bone (vertebral column), such as crabs (*crustaceans*), insects (*articulata*), or shell-fish (*molluscans*), &c.

INVOLUCEL, INVOLUCELLUM. A small or partial involucrum surrounding the secondary umbels, &c.

INVOLUCRUM. A collection of bracts at the union of several flower stems. A covering of the fructification of ferns and equisetums. In anatomy, a name for the membrane covering the heart (*pericardium*).

IODINE (from *ιωδη*, *violet*). An elementary body, of a black colour, found in lustrous scales, converted by a heat of 345° F. into a beautiful violet vapour. It closely resembles chlorine in its chemical characters; is not found in inland plants, but only in sea-weeds, and such as grow in salt marshes. Its equivalent is 126, symbol I. It combines directly with metals, forming *iodides*. With hydrogen, it forms hydriodic acid; with oxygen, it forms iodic acid. Iodine, as well as most of its compounds, is poisonous.

IOLITE. A dark-blue mineral, massive, and crystallized in six or twelve sided prisms; found imbedded in primary rocks. Composition: silica, 49·17; alumina, 33·10; magnesia, 11·48; oxide of iron, 4·33.—(*Stromeyer.*)

IPECACUANHA. *Cephaelis ipecacuanha.* A shrubby plant, of the natural family *Cinchoniaceæ*, the root of which is extensively used as an emetic. It is a native of tropical America, and especially Brazil, from whence it is exported. In 20 grain doses it is emetic; but in smaller quantities, expectorant.

IPOMÆA. A genus of plants resembling the convolvulus.

IRIDESCENT. Exhibiting bright colours by reflection.

IRIS. In anatomy, the coloured membrane of the eye which surrounds the pupil, and, by its contraction or dilation, regulates the amount of light entering.

IRIS. A genus of ornamental flowers, the flag. The *I. florentina* yields the *orris* root, esteemed for tooth-powder, from its odour resembling violets.

IRISATED. Exhibiting the prismatic or rainbow colours.

IRON. A ductile metal, sp. gr. 7·78; susceptible of magnetism, and taking a high polish. By exposure to damp air, it absorbs oxygen, becoming rust. Its ores are very numerous. Few soils are destitute of some admixture. The ashes of plants are also furnished with a small quantity.

Cast iron contains carbon, sand, and other impurities, which are removed, to a great extent, in wrought iron. The former is brittle, harder, and lasts longer when exposed than wrought iron, which is ductile, soft, malleable, and fibrous.

Steel is a compound of carbon and iron, remarkable for its elasticity and hardness. Iron combines, also, with sulphur and halogen bodies.

The equivalent of iron is 27·18, symbol Fe (*ferrum*). It combines with two proportions of oxygen, and forms, 1st. A protoxide, $1\,Fe + 1\,O =$

37·18. This is the black oxide, and exists in green vitriol and the protosalts of iron, serving as a base. 2d. The peroxide, 2 Fe + 3 O = 78·36. This is the common red or brown oxide; it is also a base, producing the persalts of iron. Iron is readily dissolved by acids, being first oxidized, and then uniting with the acid. The salts of the protoxide are, for the most part, instable, changing to peroxides when exposed to moist air.

Iron is discovered in solution by an infusion of gall-nuts, which, sooner or later, produces a black colour (ink). If the colour arises immediately, the peroxide is present; if the mixture requires stirring and exposure to air, the protoxide is present.

Many of the compounds of iron are of great interest to the farmer. The protosulphate (copperas) is much used in dyeing, in making ink, and as an emetic. In Switzerland it is added to urine and fluid manures, to fix their ammonia, which it converts into a sulphate. It is also powerfully disinfecting, removing bad smells. This body is sometimes present in marshy and peaty soils, and makes them perfectly barren; they are, however, quickly recovered by liming. The pyrolignate of iron (persalt) is used in dyeing and the preservation of timber. The muriate has the same properties, and is also a medicine. Prussian blue is a sesquiferrocyanide of iron.

The iron work of the farm should be painted with coal-tar for protection from rust, or kept in a dry place under cover. Portable fencing, hurdles, and many other fixtures on a farm are now made of iron, which heretofore were wooden. It is well adapted for the sashes of hot-houses: wire is extensively employed for slight trellises. Wires should be protected from moisture by coal-tar, or other coarse paint.

IRON PYRITES. Native sulphuret of iron; it forms a mineral often crystallized, of a golden colour. Its presence in soils produces barrenness, which is soon rectified by liming; it is the origin of most of the sulphur springs. Water flowing over the pyrites decomposes it in part, and becomes tainted with sulphuretted hydrogen.

IRON WOOD. See *Hornbeam.*

IRRADIATION. The brightness that surrounds luminous objects, and increases their apparent size.

IRRIGATION. "Of all the substances which concur in the vegetation and growth of plants, water is the most essential; without moisture the seed cannot germinate, nor can the plant receive nourishment. Hence in warm climates, where rains are periodical, and where the soil is dried and parched by a continued evaporation, no verdure exists, except where springs or rivers supply the waste of moisture. The warmer the climate, and the more rapid the evaporation, the more luxuriant is the vegetation, provided there be an abundant supply of water. This circumstance has suggested the plan of diverting streams and conducting them in channels to fertilize as great an extent of land as possible. The water used always contains saline and other matters very necessary to the growth of plants, and which are supplied by irrigation.

"If water stagnates and is evaporated, and the noxious matter held in solution remains in the soil, all the advantage of irrigation is lost, and the better kinds of grasses are succeeded by rushes and coarse aquatic plants, as may be seen in all marshy spots. The circulation of the water, therefore, appears to be as necessary as its presence; and, provided there be a sufficient supply of water of a proper quality, the more porous the soil, and especially the subsoil is, the more vigorous is the vegetation. It is on this principle alone that we can rationally account for the great advantage of irrigation in those climates where rain is abundant, and where the soil, which is most benefited by having a supply of water running through it, is of a nature to require artificial draining as an indispensable preliminary to being made fertile by irrigation. By keeping these principles in view, great light will be thrown on the practical part of irrigation, which, having been long established by experience, before these principles were thought of, depends not on their correctness, but only confirms their truth.

"The whole art of irrigation may be deduced from two simple rules, which are, first, to give a sufficient supply of water during all the time the plants are growing; and, secondly, never to allow it to accumulate so long as to stagnate. We shall see, hereafter, one apparent exception to this last rule, but it will be readily explained.

"The supply of water must come from natural lakes and rivers, or from artificial wells and ponds, in which it is collected in sufficient quantity to disperse it over a certain surface. As the water must flow over the land, or in channels through it, the supply must be above the level of the land to be irrigated. This is generally the principal object to be considered. If no water can be conducted to a reservoir above the level of the land, it cannot be irrigated; but there must also be a ready exit for the water, and therefore the land must not be so low as the natural level of the common receptacle of the waters, whether it be a lake or the sea to which they run. The taking of the level is therefore the first step towards an attempt to irrigate any lands.

"Along the banks of running streams nature points out the declivity. A channel, which receives the water at a point higher than that to which the river flows, may be dug with a much smaller declivity than that of the bed of the river, and made to carry the water much higher than the natural banks; it may thence be distributed so as to descend slowly, and water a considerable extent of ground in its way to rejoin the stream. This is by far the most common mode of irrigation, and the shape, size, and direction of the channels are regulated by the nature of the surface and other circumstances, which vary in almost every situation. A few examples will give to those who are not acquainted with the best modes of irrigating land, a pretty accurate notion of the system.

"We shall suppose a river to run with a rapid current between high banks: at some point of its course a portion of the water is diverted into a canal dug along the bank with a very small declivity. The water in this canal will flow with less rapidity than the river, but will keep the same level as that part of the river where it has its origin. Thus the water may be carried over lands which are situated considerably above the bed of the river farther down. All the lands between this canal and the river may be irrigated, if there is a sufficient supply of water. The canal may be carried to a considerable distance from the river. The size of the canal and its declivity depend on the quantity of water which may be made to flow into it. A dam is often constructed across a stream, in order that as much of its water as is possible may be diverted, and the original channel is often laid quite dry, to take advantage of all the water at the time when it is advantageous to irrigate the land. To have an entire command of the water, there are flood-gates on the main channel and on the lesser branches; by opening or shutting these, the water may be stopped or made to flow as may be required. It must be remembered that, to carry water to a considerable distance, and in great quantity, a larger channel and more rapid declivity are required; and it is a matter of calculation whether it is most advantageous to bring a smaller quantity to a higher point, or a greater abundance somewhat lower. Having a certain command of water, it may be carried from the main channel by smaller branches to different points, so as to irrigate the whole equally. These branches should be nearly horizontal, that the water may overflow the sides of them, and be equally distributed over the land immediately below. Every branch which brings water over the land should have a corresponding channel below to carry it off; for the water must never be allowed to stop and stagnate. When it has run 15 or 20 feet, according to the declivity, over the land situated below the *feeder*, or the channel which brings the water, it should be collected into a drain to be carried off, unless it can be used to irrigate lands which lie still lower. Finally, it runs back into the river from which it was taken at a lower point of its course.

"When there is a considerable fall and a sufficient supply of water, a series of channels may be made, so situated below each other that the second collects the water which the first has supplied, and in its turn becomes a feeder to irrigate the lower parts of the declivity; a third channel receives the water and distributes it lower down, until the last pours it into the river: this is called *catch-work*, because the water is caught from one channel to another. This method is only applicable where there is a considerable fall of water and a gentle declivity towards the river. But it must be borne in mind that the water is deteriorated for the purpose of irrigation when it has passed over the land, and that it is not advantageous to let it flow over a great extent when a fresh supply can be obtained; but where only a small portion of water can be commanded, that must be made the most of; and it will irrigate three or four portions of land in succession without there being any very marked difference in the effect: beyond this it rapidly loses its fertilizing qualities.

"The general principle of irrigation may be described as the supplying of every portion of the surface with an abundance of water, and taking it off again rapidly. In many situations, the great difficulty in irrigation arises from the want of a supply of water; but even then a partial irrigation may be effected, which, although not perfect, will have its advantages. A small rill, which is often quite dry in summer, may still, by judicious management, be made to improve a considerable portion of land; its waters may be collected and allowed to accumulate in a pond or reservoir, and let out occasionally, so that none be lost or run to waste. If there is but a small quantity, it must be husbanded and made to flow over as great a surface as possible. If there is water only at particular seasons of the year, and at a time when it would not be of much use to the land, it may be kept in ponds, and it will lose none of its qualities by being exposed to the air. If animal or vegetable matter, in a partial state of decomposition, is added to this water, it will much improve its quality, and by a judicious distribution of it over the land, a great benefit may be obtained.

"If there is not a want of water, there may be a want of declivity to enable it to flow off, which, it should always be remembered, is an essential part of irrigation: art may in this case assist nature, by forming a passage for the water, either in its course towards the land to be irrigated, or from it after it has effected its purpose. Where there is no natural exit—and it might lead to too great an expense to make an artificial one—the water may sometimes be led into shallow ponds, where a great part is evaporated; or porous strata may be found by boring, into which it can be made to run and be dispersed. Along rivers where the fall is very imperceptible, a channel, brought from a considerable distance, may give such a command as to throw the water over a great extent of surface; and to carry it off, another channel may be cut, emptying itself at some distance below; so that lands which lie along the banks of a river may be irrigated, although they are actually below the level of the river, and require banks to protect them from inundation.

"When the surface to be irrigated is very flat and nearly level, it is necessary to form artificial slopes for the water to run over. The whole of the ground is laid in broad beds, undulating like the waves of the sea.

The upper part of these beds is quite level from end to end, and here the channel, or float, which brings the water on, is cut. From the edge of this channel the ground is made to slope a foot or two on both sides, and a ditch is cut at the bottom, parallel to the float (*Fig.* 3). The whole of the ground is laid out in these beds. All the floats are supplied by a main channel, at right angles to the beds, and somewhat above them, and all the ditches or drains run into a main ditch, parallel to the main float, and below the lowest drain. The course of the water is very regular. As soon as the flood-gates are opened, it flows into all the upper channels, which it fills till they overflow in their whole length. The sloping sides are covered with a thin sheet of running water, which the lower drains collect, and carry into the main ditch. The upper drains should be puddled, to hinder the water from sinking.

"Experience has shown that there are particular seasons when the water has the best effect; a perfect command of it is, therefore, indispensable, and also a regular supply. During mild frost, when all dry meadows are in a state of torpor, and the vegetation is suspended, the water meadows, having a current of water continually flowing over them, are protected from the effect of frost, and the grass will continue to grow as long as the water flows over it. Too much moisture, however, would be injurious, and the meadows are therefore laid dry by shutting the flood-gates whenever the temperature of the air is above freezing. By this management the grass grows rapidly at the first sign of spring. Before the dry upland meadows have recovered the effects of frost and begun to vegetate, the herbage of the water meadows is already luxuriant, the effect being due to the temperature of the water, which must be above that of freezing. As soon as they are fed off or cut for the first crop of hay, the water is immediately put on again, but for a shorter time; for the warmer the air, the less time will the grass bear to be covered with water. A renewed growth soon appears, and the grass is ready to be cut a second time when the dry meadows only give their first crop. Thus, by judicious management, three or four crops of grass are obtained in each season, or only one abundant crop is made into hay, and the sheep and cattle feed off the others. The early grass may be fed till the end of April. A short flooding soon reproduces a crop, which is mowed for hay in June; another flooding gives an abundant after-math, which is either mowed for hay, or fed off by cows, bullocks, and horses; for at this time the sheep, if pastured in water meadows, are very subject to the rot. The value of good water meadows could scarcely be believed by those who are not familiar with them. Where the water is suited to irrigation, they never require manuring. The fertility is kept up continually, and the only attention required is to weed out coarse aquatic plants, which are neither nutritious nor wholesome in hay or pasture.

"The best soil for a water meadow is a good gravel. The finest water meadows on the Avon, in Wiltshire, where the richest herbage is found, have scarcely any soil at all, but are on a bed of shingle and pebbles, matted together by the roots of the grass; which proves to demonstration that the waters of the Avon contain all the principles essential to rapid vegetation. Great attention is required, and some experience, to irrigate meadows so as to give the greatest profit.

"In hot weather, when we should imagine that the land must be thirsty, and that too much water cannot be poured over it, much mischief may be done by injudicious flooding. In winter, on the contrary, the land may be covered with water for weeks without injury; and if an earthy deposite takes place, the subsequent fertility is greatly increased. But this is not properly irrigation; it is inundation; and the effects depend on entirely different causes. When low meadows are inundated in winter and spring, it is the muddiness of the water which enriches the land; a fine layer of extremely divided matter is deposited, and when the water subsides this acts as a coat of manure.

"Water may be carried in small channels through meadows without being allowed to overflow; and in this case the effect is similar to that caused by rivers or brooks which wind slowly through valleys, and produce a rich verdure along their course. This is watering, but not properly irrigating. When this is done judiciously, the effect is very nearly the same as when the land is irrigated; and in hot climates it may be preferable, by giving a constant supply of moisture to the roots while the plants are growing. The great advantage of water meadows is not so much the superior quantity of grass or hay which is obtained when they are mowed, as the early feed in spring, when all kinds of nutritive fodder are scarce. At that time an acre of good grass may be worth as much for a month as a later crop would for the remainder of the year. When it is intended to form a water meadow on a surface which is nearly level, or where a fall of only two or three feet can be obtained in a considerable length, the whole of the land must be laid in beds about 20 or 30 feet wide, the middle or crown of these beds being on a level with the main feeders, and the bottoms or drains on a level with the lower exit of the water, or a little above it. To form these beds most expeditiously, if the ground is already in grass, the sod may be pared off and relaid after the beds are formed, by which means the grass will be sooner re-established; but, except in very heavy soils, where the grass is some time in taking root, the easiest and cheapest way is to plough the land two or three times towards the centre, and dig out the drain with the spade. The earth out of the drains, and that which is taken out of the upper trench or feeder, may be spread over the bed, to give it the proper slope. A roller passed over the bed in the direction of its length will lay it even, and the seeds of grasses being sowed over it, the water may be let on for a very short time, to make them spring. As soon as the grass is two or three inches above ground, a regular flooding may be given, and in a very short time the sward will be complete. Instead of sowing seed, turfs of grass cut from old sward may be spread over the newly-formed beds, and they will soon cover the ground. The Italian rye grass grows so rapidly that, if it be sowed as soon as the snow and frost are gone, it will afford a good crop to feed off in May, or to mow for hay by June, and after that it may be cut repeatedly during the summer; but where the soil is good and the water abundant, good natural grasses will spring up without much sowing, and soon equal the old water meadows.

"It seems essential to the formation of a good water meadow, that the bottom be porous, and free from stagnant water; hence under-draining is often indispensable before a water meadow can be established; and a peat bog, if drained and consolidated, may have water carried over its surface, and produce very good herbage. If the soil is a very stiff clay, draining is indispensable, where a water meadow is to be made. The more porous the soil, the less depth of water is required, which is not obvious at first sight; but the clay lets the water run over the surface without soaking into the roots, whereas the porous soil is soon soaked to a considerable depth. The water must, therefore, be longer on the clay than on the sand or gravel to produce the same effect. If the water is properly applied, all kinds of soils may be converted into fertile water meadows. On very stiff clays a coat of sand or gravel, where it can be easily put on, will greatly improve the herbage. It should not be ploughed in, but laid on the surface, two or three inches thick.

"The usual time of letting on the

water on water meadows is just before spring, and it may continue to flow over the land as long as the frost lasts; in mild weather it may be turned off during the day and put on again at night, until the frost is gone. The grass will soon begin to grow, and be ready to be fed off. When this is done, the water is immediately let on for a short time, and turned off again to allow the ground to dry after a few days' flooding, and the water is let on again at short intervals. The warmer the air is, the shorter time must the water be allowed to cover the meadows. As soon as the grass is five or six inches long it must be left dry entirely till it is mowed or fed off. In summer the floodings must be very short, seldom more than twenty-four hours at a time, but frequent. Thus a great weight of grass may be obtained, year after year, without any manure being put on the land, care being taken that, where the surface is not quite even, the hollows be filled up with earth brought from another place, or dug out of the drain, if that should be partially filled up with the soil which the water has carried into it. We alluded before to a case where water may remain a considerable time on the land without injury; this is when there are inundations from rivers which rise above their beds in spring, and cover the low meadows which lie along their banks. In this case, the grass, which had not yet sprung up, is protected from the cold; and if there is a deposite from the water, there is a considerable advantage; but when it subsides it must be made to run off entirely, without leaving small pools, by which the grass would invariably be injured. Small ditches or channels are usually dug, by which all the water may run off, unless where the subsoil is very porous, or the land is well under-drained, which is seldom the case in these low meadows, for the drains would be apt to be choked by the earthy deposite from the water. These inundations can sometimes be regulated by means of dikes and flood-gates, in which case they partake of the advantages of irrigation, and also of that deposition of fertilizing mud which is called warping. See *Warping*.

"The opposite plan (*Fig.* 1) will explain what has been said respecting the different modes of irrigating land. A A is a river, which has a considerable fall, and then flows through a level plain. Channels are cut at B B, where there is a rapid fall over a natural or artificial dam. The channels are carried round a hill, and supply a series of channels, C, C, C, placed below each other, forming catch-work along a declivity. A portion of the water goes on to D, where it supplies the feeders of a regular set of ridges, or beds, made as before described, from which the water returns into the river by a main trench, into which all the drains run. E E represent flood-gates, to direct the water into different channels.

"On the other side of the river, where the slopes lie somewhat differently, there are several examples of catch-work, the black lines representing the drains which receive the water after it has flowed over the surface, and carry it into the river below. It is evident that all the feeders are nearly horizontal, to allow the water to flow over their sides."

Fig. 2.

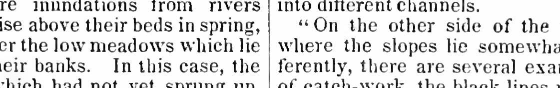
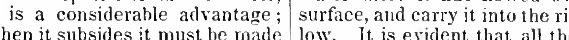


Fig. 2 is the section of catch-work. *a*, *a* are the feeders; *b*, the drains; *c*, *c*, *c*, *c*. intermediate channels, which act as feeders and drains.

Fig. 3.



Ridge-work.

Fig. 3 is the section of two adjoining ridges. *a*, *a* the feeders; *b*, *b*, *b* the drains.

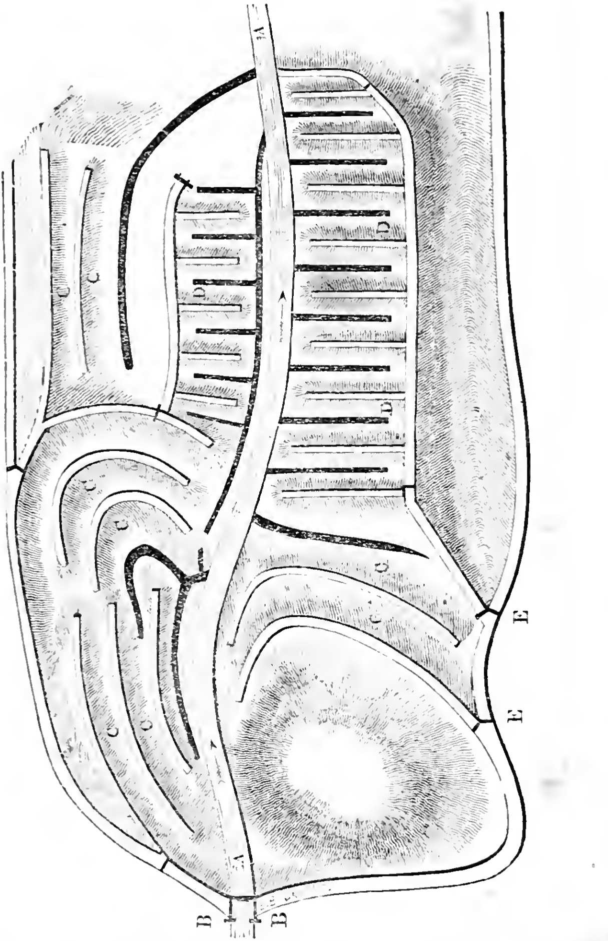
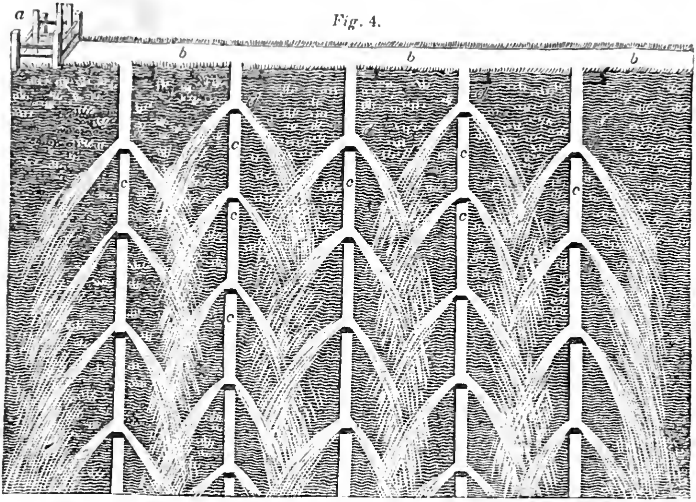


Fig. 1.

Figure 4, on the following page, represents a plan of irrigation where the soil is very porous and gently inclined, the supply of water being abundant. The flood-gate, *a*, which may be replaced by the perforated trunk of a tree, allows water to flow into the upper straight ditch, *b*, *b*, which is well puddled; from this the water descends into the channels, *c*, *c*, *c*, which run down hill; they are stopped at intervals with small banks of clay or turf, which cause a portion of the fluid to shoot out over the land and moisten the field. There is no catch-work necessary, as the excess of water percolates into the soil. The inundation practised in Carolina and elsewhere, for the cultivation of rice, is warping, and can hardly be

Fig. 4.



said to be irrigation, inasmuch as the principal object is to kill weeds.

The Dutch and Germans often distribute fluid manures by a system of irrigated work. Where a head of water is wanting, pumps may be used to raise it, the fluid running in a gutter to the upper ditch.

Fig. 5.

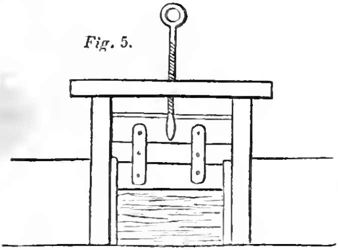


Fig. 5 is a simple kind of sluice to regulate the flow of water.

IRRITABILITY OF PLANTS. Many plants, as the sensitive mimosas, exhibit a power of contracting their leaflets upon touch; this phenomenon, the most prominent of those attributed to the irritability of plants, is a mechanical function depending upon the action of light. Plants possess no nervous system, and are therefore incapable of voluntary motion, or any other than chemical and mechanical movements.

IRRITATION. In farriery, an increased vascularity of any part, with pain, but not amounting to inflammation. It is treated like inflammation, but by milder means.

ISCHIUM. The lower portion of the haunch bone.

ISCHURIA. Retention of urine.

ISINGLASS. Pure *gelatin* obtained from the sounds of fish; it is also manufactured from calves' feet, &c.

ISNARDIA. A genus of aquatic weeds.

ISOLATED. In electricity, surrounded by non-conductors, as glass, dry silk, resin.

ISOMERISM, ISOMERIC (from ισος, *equal*, and μερος, *part*). Compounds having the same number of atoms of the same bodies, but exhibiting dissimilar properties, are called *Isomeric*. Chemists consider that the difference arises from a distinct grouping or aggregation of the atoms. Very many organic bodies are isomeric, as starch (*amylin*) and dextrine: $C_{12}\,H_{10}\,O_{10}$: cyanic and fulminic acids,

&c. It is in consequence of the frequent isomerism of organic compounds that changes so readily occur in them, either in plants, or by the action of ferments.

ISOMORPHISM, ISOMORPHOUS (from ισος, and μορφη, *form*). Having the same crystalline form; this is associated with the same number of atoms, but of unlike elements, and also with similar properties. Thus, alum consists of sulphuric acid, alumina, and potash; but either of these bodies may be replaced by certain other *isomorphous* bodies; the sulphuric acid by the selenic, chromic, or manganic acids: the last two of these produce a difference of colour in the crystal, but little else. The alumina may be replaced by peroxide of iron, sesquioxide of manganese, or sesquioxide of chromium; and the potash, by soda or hydrated ammonia. Thus, the alum may have none of its primary constituents, but isomorphous atoms of the same number.

Isomorphism, or the study of these changes, is of great importance in agriculture, for it is found that the same substitution takes place in organic bodies. This is not, however, a matter of indifference; for the presence of soda in grapes, instead of potash, deteriorates their flavour; lime in the place of potash, in tobacco, injures its excellence; and lime or potash in place of soda, in onions and asparagus, is also injurious to their mildness. The limit of isomorphous substitution is a chemical inquiry: so far as we know, there are groups of bodies which can be substituted for one another only; these have the same amount of oxygen in their composition. Such groups as are of importance to the farmer or gardener are appended.

ISOMORPHOUS GROUPS. Potash, soda, hydrated ammonia (NH_4O, oxide of ammonium), hydrate of lime (CaO, HO). Of this group soda only replaces potash in cerealia; but lime, ammonia (or organic alkalies), can replace potash or soda in plants that do not require soluble silicates, as tobacco, potatoes, &c.

Sulphuric acid is replaced by the telluric, selenic, chromic, and manganic acids, none of which, however, are abundant in common soils.

Phosphoric acid is isomorphous with the arsenic acid ($As\,O_5$), which will seldom be found in soils.

Iron, as the peroxide ($Fe_2\,O_3$), is isomorphous with alumina ($Al_2\,O_3$), oxide of chrome ($Cr_2\,O_3$), and sesquioxide of manganese. These substitutions, although of no apparent moment, are continually occurring in plants.

ISOPYRE. A siliceous mineral resembling obsidian, found in granite, basalt, and primary rocks.

ISOSCELES (from ισος, and σκηλος, *a leg*). A name given to the angle two of whose sides are equal.

ISOTHERMAL (from ισος, and ϑέρμη, *heat*). Having the same average temperature. Geographical lines drawn over the surface of countries, and passing through places having the same average heat, are termed *isothermal lines*; they are very irregular, in consequence of the occurrence of mountains and large lakes or surfaces of water, which modify the temperature. The terms *Isotheral* and *Isochimenal* are used also; the first, to designate a line showing the places having the same summer heat, and the last, those with the same mean winter temperature.

"According to Humboldt, the isothermal line which corresponds to the temperature of 32° Fahrenheit passes between Ulea, in Lapland, lat. 66°, and Table Bay, on the coast of Labrador, lat. 54°. The isothermal line of 41° passes near Stockholm, lat. 59½°, and St. George's Bay, Newfoundland, lat. 48°. The line of 50° passes through the Netherlands, lat. 51°, and near Boston, in the United States, lat. 42½°; that of 59° between Rome and Florence, lat. 43°, and Raleigh, in North Carolina, lat. 36°. In all these cases we see that the isothermal lines, in passing from the western side of the continent of Europe to the eastern coast of America, deviate very considerably towards the south, the deviation, in one case, amounting to 11½° of latitude. In passing over the American continent they again recede to the northward; and in California, and to the north of that peninsula, along the western side of the continent, the annual temperature is nearly the same as under similar latitudes in the west of Europe. From the western to the eastern side of the old continent, the flexure of the isothermal curves and the diminution of the mean annual temperature under the same parallels are not less conspicuous. The isothermal line of 55° passes through Nantes, lat. 47°, and Pekin, lat. 39½°. Edinburgh and Kasan (in the east of Russia) have the same latitude; but the mean annual temperature of the former is 48°, while that of the second is below 38°."

ISSUE. In farriery, an artificial ulcer, made by cutting through the skin and inserting a pea or smooth stone in the wound; it is to be carefully dressed and washed daily. It is a means of establishing a local irritation to relieve some important organ, as the eye.

ITALIAN RYE GRASS. *Lolium perenne.* See *Grasses.*

ITCH. A disease of the skin, in which small vesicles are produced in the angles of the body by the irritation of an insect. It is cured by an ointment of sulphur applied daily. It is sometimes called *mange* in farriery.

IULUS. The generic name of the gally worm; insects with numerous feet (*myriapoda*).

IVORY. The compact bony structure of the tusks of elephants; it contains 66 per cent. bone earth and 24 gelatin.

IVORY BLACK. Bone black.

IVY. *Hedera helix.* A hardy evergreen climbing shrub, used for rustic coverings: it kills trees. It is readily propagated by cuttings, and once trained to a wall, will hold on by its own branch roots. The Virginian creeper is sometimes called American ivy, but in no way resembles true ivy.

IVY, IRISH (*Canatiensis*). "A fast-growing climber, with large lobed leaves, which soon covers walls and houses. It is propagated by layers, or slips taken off and planted where they are to grow."—(*Johnson.*)

J.

JACK. A general name given to engines for raising heavy weights, as well as some used for turning spits, &c.

JACKDAW. A species of crow (*Corvus monedula.*)

JACK TIMBERS. Those in a bay of timbers which are shorter than the rest.

JACOB'S LADDER. *Polemonium ceruleum.* A common flower.

JACOB'S STAFF. The *cross staff* used by surveyors in measuring heights and distances.

JADE. Nephrite.

JALAP. The root of the *Ipomæa jalapa*, a convolvulaceous, Mexican plant, which might be readily cultivated in the Southern States. It climbs, and has a perennial root, or tuber, which is large enough for the market in three years. It is a powerful purge, the dose being ten to twenty grains for a man.

JAMAICA PEPPER. *Myrtus pimenta.* Allspice, the produce of an evergreen tree of tropical America. The berries are warm and aromatic.

JAMBS. The sides or posts of any aperture or door which bear the cross piece on which the weight of the wall rests.

JAMESTOWN WEED. *Datura stramonium.* A poisonous weed. See *Stramonium.*

JASPER. An ornamental and coloured silicious mineral.

JATROPA. A genus of euphorbeous, tropical plants, of which the *J. Manihot* yields a root from which cassava is extracted; the *J. curcas*, purging seeds resembling castor oil seeds.

JAUNDICE. A disease in which the biliary secretion is much changed, the skin coloured yellow, with much lassitude.

JEFFERSONITE. A kind of augite.

JEJUNUM. The portion of the

small intestines next the duodenum.

JELLY. Gelatin with water: *vegetable jelly* is pectin.

JERUSALEM ARTICHOKE. See *Artichoke*.

JESSAMIN. *Jasminum officinale*. A climbing shrub, the flowers of which, when distilled with water, yield a penetrating perfume.

JET. A bituminous coal of fine texture, and taking a high polish.

JETERUS. The yellows of plants.

JOGGLED JOINTS. Joints of masonry or wood, which are made by indenting the faces and fitting them together.

JOGGLE PIECE. A truss post, whose shoulders and sockets receive the lower ends of the struts.

JOHN'S WORT. Plants of the genus *Hypericum*, especially *H. perforatum*, a common weed in meadows. Much prejudice exists against it, and, being a perennial-rooted plant, it is not easy of extirpation. A kind of itch, and even inflammation of the stomach, are said to be produced by it in sheep, but salt is said to be a preventive, and the itch is treated with sulphur ointment.

JOISTS. The timbers to which the flooring is nailed.

JUBA. The mane, or crest of hair which runs along the back bone of animals.

JUDAS-TREE. An ornamental genus (*Cercis*) of trees, of which the *C. Canadensis*, or red bud, is the only indigenous species.

JUGAL BONE. The cheek bone.

JUGULAR VEINS. The veins running on the sides of the neck, which bring the blood from the head. The external jugular is that from which blood is taken in the horse.

JUGULUM. The fore part of the neck in animals.

JUJUBE. *Zizyphus vulgaris*. The fruit of this shrub, or small tree, resembles a small plum, and is edible; is red, with a coriaceous skin, and of the size of a large olive: they are readily dried, and become sweeter. It is a native of Italy and Spain. A sirup made from the dried fruit and mixed with gum forms the original jujube paste.

JULY. In the North, corn, potatoes, and late crops are tilled for the last time, and white crops and grasses harvested; late cabbages set out; celery put into trenches, and seeds collected. After harvest, turnips, carrots, and fall crops are put in: budding is performed on the apple and pear. In the South, cotton and tobacco receive a last working. It is the great month for working the soil, and destroying weeds and shrubs.

JUNCACEÆ. The family of rushes.

JUNE. In the North, potatoes for winter and ruta bagas are set; sheep sheared. Weeding is very important this month. Fruit-trees are trimmed, and caterpillars destroyed; late garden vegetables, as pease, beans, cabbages, turnips, melons, are also sown. In the South, this is the month for weeding, hoeing, and working corn, cotton, tobacco, sweet potatoes; of the last, increase the hills by cuttings. Carrots and other roots for late crops, as well as cabbages, may be sown; melons require working; white crops are harvested.

JUNE BERRY. *Mespilus arborea*. Wild pear, service. This tree is found extensively diffused in the United States, but abounds on the Alleghany Mountains, and the banks of its streams. The fruit is scattered, small, one third to one half an inch across, and pleasant. It is improved by cultivation, and ripens in June. On the streams of the West it sometimes grows thirty-five to forty feet high.

JUNGERMANNIACEÆ. A natural family of aerogens, resembling mosses, and growing on the bark of trees, and in moist, shady places. The *Hepaticæ*, or true liverworts.

JUNIPER BERRIES. *Juniperus communis*. A bushy evergreen shrub, the berry of which yields an aromatic flavour to gin. The shrubs grow readily on the poorest soils: they are of the pine family (*coniferæ*).

JUNIPERUS. The genus yielding the juniper berries. It contains, also, the *J. Sabina* (savine), *J. Virginiana* (red cedar).

K.

KALE. A name for some varieties of cabbage or borecole.

KALE, SEA. See *Sea-kale.*

KALI. A contraction for alkali, potash ; also the ashes of *salsola kali*, or barilla.

KALIUM. Potassium.

KALMIA. A genus of handsome flowering shrubs, called American laurels. The leaves and flowers are poisonous, especially to lambs : those poisoned should be drenched with milk and castor oil.

KAOLIN. Porcelain clay, the fine, white, disintegrated feldspar of some primitive countries.

KATYDID. A kind of grasshopper inhabiting trees, the *Platyphyllum concavum* of Harris.

KEEL. *Carina.* The two lower petals of papilionaceous flowers are termed the keel.

KELP. A term used both for seaweeds and their ashes. See *Seaweeds.* The ashes used to be sold for the manufacture of soap and glass, but is now superseded, in a great measure, by manufactured carbonate of soda.

KENNEL. A hole inhabited by a fox or other animal. A shelter for dogs. It should be kept clean, and the straw changed often. A kennel is also used to designate a collection or pack of hounds.

KERMES GRAINS. Insects of the genus *Coccus*, or bark lice, collected from numerous plants, as the oak, &c., and formerly much used for dyeing a red colour, but to a great extent superseded by *cochineal.*

KERMES MINERAL. The hydrosulphuret of antimony.

KETCHUP. Catsup.

KEUPER. The upper portion of the new red sandstone formation.

KEY. In building, a piece of wood let into another in the contrary direction of the grain.

KEYSTONE. The central stone of an arch.

KID. A young goat. The flesh is tender, and much esteemed by some persons.

KIDNEYS. The reins. The organs in which urine is secreted, from whence it flows along tubes (ureters) into the bladder. They are situated in the loins and attached to the spine.

KIDNEY BEAN. See *Bean.*

KIDNEY-SHAPED. Reniform, of an oval figure, with one side indented, so as to resemble a sheep's kidney.

KIDNEY VETCH. *Anthyllis.* An ornamental flowering plant.

KILLING ANIMALS. It is customary to keep oxen two days, and smaller animals one day without food. The ox is felled by a blow on the forehead, and his throat immediately cut. The Jews, who eat no meat with blood in it, do not fell the animal, but, having tied it, divide the throat down to the bone. Animals killed by accidents are eaten with propriety, but such as die from disease are unwholesome, and sometimes poisonous. A method of killing animals by pithing, or dividing the spinal marrow high in the neck by a sharp knife, is practised in Southern Europe ; the animal falls at once, but the flesh is said not to be free from blood.

KILLINITE. A greenish lamellar mineral, consisting of silica, alumina, and iron, with six per cent. potash.

KILN. A furnace. The figure depends on the object in view.

KILN ASHES. The ashes of the wood, straw, &c., used in burning.

KILN-DRYING. Drying hops, malt, grain, &c., in a chamber, or over a wire-work heated to 120° Fahrenheit and upward by a kiln or stove below.

KILOGRAMME. A French weight, equal to 2 lbs., 3 oz., 5 dwts., avoirdupois.

KING-POST. The central post of a trussed framing for supporting the tie beam.

KINIC ACID. The acid with which quina is associated.

KINO. A dark-brown astringent extract containing much tannin.

KIRSCHWASSER. A liquor obtained by fermenting cherries with which the stones are pounded, and distilling the fermented liquid.

KIT. A pail, or wooden vessel.

KITCHEN GARDEN. See *Garden Husbandry.*

KNAPWEED. The genus of perennial weeds *Centaurea.*

KNAWELL. *Scleranthus annuus.* A weed slightly astringent.

KNARS. Knots or excrescences on the bark of some trees, which contain latent buds capable of expanding into branches: those of the olive are used for propagation, being cut with a part of the stem and set in the ground.

KNEE. In architecture, an artificially or naturally bent piece of timber.

KNEE-PAN. A small, flat bone (*patella*) situated before the knee joint to protect it.

KNEE GRASS. Rough panic grass.

KNOLL. A hillock, or small hill.

KNOPPERN. Gall-like excrescences of oaks, used for dyeing and tanning.

KNOT GRASS. *Holcus avenaceus*, which produces bulbs on its roots. The common weed *Polygonum aviculare.*

KNOT WEED. A general name for the *Polygonum* genus, many of which are very acrid.

KOHL RABI. A variety of cabbage, the stalk of which is terminated above by a bulb as large as a turnip, which is solid, and around which the leaves are situated. It requires the same management as cabbages, and yields as much as ruta bagas. Two pounds of seed supply an acre; it is sown in beds in the fall and planted in spring. The value as food is not given, but it is probably about the same as cabbages, 500 pounds equalling 100 of hay, and an ox requiring 100 pounds daily. Kohl rabi is cultivated in Germany, and recommended lately in England, from its comparative freedom from the diseases of turnips, as a substitute for that root. It has occupied the attention of some of our fancy gardeners, but is not raised by us as a field-crop.

KRAMERIC ACID. It is obtained from the root of the *Krameria triandria*, or rhatany.

KYANITE. A silicate of alumina, sometimes coloured by iron and other bodies: it occurs in doubly oblique prisms; is white, gray, or blue. It is common in primitive formations, and sometimes forms a fine blue stone resembling sapphire, and used by jewellers.

KYANIZING. The process of Mr. Kyan for preserving timber by soaking it in a solution of corrosive sublimate: it is now superseded by cheaper fluids. See *Preservation of Timber.*

L.

LABARRAQUE'S DISINFECTING LIQUID. A solution of carbonate of soda charged with chlorine: it answers the same purposes as chloride of lime in disinfecting rooms.

LABELLUM. The lower petal of a labiate or orchideous flower.

LABIATÆ. An extensive family of plants, characterized by a two-lipped, monopetalous corolla, an irregular number of stamens, and four-lobed ovary. They are mostly herbs, or small shrubs, with highly aromatic flowers and leaves, as the mint, lavender, sage, &c. None of them are poisonous.

LABIUM. A lip, the divisions of some monopetalous flowers. In entomology, the moveable organ which is at the front of the head, or face, covering the mouth and representing the upper lip.

LABORATORY. The workshop of the chemist: chemical manufactories are often improperly so called.

LABRADORITE, or LABRADORE STONE. An iridescent, opaline variety of feldspar, consisting of silica, 55; alumina, 24; lime, 10·25; soda, 3·50, in 100 parts.—(*Klaproth.*)

LABRUM. The labium, or upper lip of insects.

LAC. The dry resinous juice of several trees of Southern India. The trees are wounded by the *Coccus ficus*, a bark louse, parts of which being entangled in the juice, produce a red colour like cochineal. The fresh lac, incrusting twigs of trees, is called *stick lac;* the resin being separated, pounded, and stirred with water, yields a red solution, which, when evaporated to dryness, forms *lac dye*, the insoluble portion being *grain lac*, and, when melted and run on leaves or wood, *shell lac.*

LAC DYE. This is found in small cakes; it is dissolved in a mixture of 3 lbs. tin and 60 muriatic acid. To produce a rich scarlet, the cloth is mordanted with solution of tin.

LAC, SHELL. This is much used for the best sealing-wax by various manufacturers, and in varnishes. It is rapidly dissolved by strong alcohol, by dilute muriatic and acetic acids. Laccine and laccic acids are bodies found in lac.

LACERATED. A botanical term, used to designate a leaf which appears to have been torn.

LACERTIDÆ. The family of lizards.

LACHRYMAL GLAND. A small conglomerate gland placed in the upper portion of the outer angle of the eye; it supplies the eye with moisture to lubricate the surface; an excessive flow produces tears. The lachrymal duct is a small channel from the inner corner of the eye to the inside of the nose.

LACINIATE. Fringe-like; petals, leaves, &c., cut into numerous thin shreds.

LACQUER. A varnish used to cover brass and other metals, made by dissolving shell lac in alcohol, and colouring with gamboge, saffron, and other bodies.

LACTARY. A dairy.

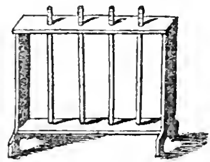
LACTATION. Giving milk, or suckling.

LACTEALS. Minute vessels running from the interior of the small intestines along the mesentery to the thoracic duct; they convey the chyle or nutritious portions of digested food. They form the lacteal glands of the mesentery.

LACTIC ACID. The acid of sour milk; it is also found in digested food, and sour starchy substances, saur kraut, &c. It is a thick, colourless, sour liquid, soluble in water and alcohol, and coagulates milk: formula $C_6 H_4 O_4$. It readily combines with bases, forming *lactates.*

LACTINE. Sugar of milk.

LACTOMETER, or GALACTOMETER. "A term applied to a glass tube for ascertaining the proportion which the cream bears to the milk of any particular cow, or the produce of a whole dairy. Lactometers of different kinds have been invented; the best is called the four or five glass lactometer (*Fig.*).



"The principle of the instrument is, that if new milk is poured into glass tubes and allowed to remain, the division between the cream which floats upon the surface of the milk will be so evident that its depth may be easily measured; and should the milk from any cow produce more cream than that of another, the difference will be seen by the divisions or marks on the glass tubes. The lactometer consists of four or five glass tubes, about half an inch diameter and 11 inches long, fitted into an upright mahogany frame; each tube having a fine line drawn round it 10 inches from the bottom; three inches from the line downward it is graduated into inches and tenths of inches. At milking time each tube is to be filled up to the line with new milk. After standing 12 hours, the quantity of cream which floats upon the surface is shown by the scale of inches and tenths; each division will therefore represent one per cent. of the whole.

"If the milk given by a cow at one meal is one gallon, or eight pints, and the thickness or depth of the cream which floats upon it measures 14 divisions, multiply the number of pints, 8, by the depth of the cream, 14; the result will be that the produce of the cream of that meal is 112, or one pint twelve one hundredths. Care must be taken to fill these tubes as soon as the pail is taken from under the cow, for if any delay takes place some of the cream will have ascended towards the top. The milk should be taken from the middle of the pail, which is to be done by dipping a cream-pot below the froth."—(*Journ. Roy. Inst.*)

LACTUCARIUM. The dry juice of the wild lettuce (*Lactuca virosa*): it is very much like opium.

LACTUCIC ACID. It exists in lactucarium.

LACUNA. A small pit. The mouth of excretory ducts.

LACUNOSE. Having little pits, or shallow indentations.

LACUSTRINE. Belonging to a lake.

LADDER. A necessary implement on the farm for stacking, repairing, &c. The wall-tree ladder is furnished at the top with two pieces of wood projecting 10 inches, to hinder it from injuring the trees in pruning, nailing, &c. An arrangement of three ladders on a frame, capable of being wheeled along, and in which two of the ladders may be hoisted one above the other, so as to reach to the top of trees, is called an orchard ladder.

LADY BIRD. A popular name for the genus *Coccinella*. Most of the species are useful to the farmer by preying on plant lice, or aphides.

LADY'S MANTLE. Plants of the genus *Alchemilla*; they are slightly astringent, but wholesome.

LADY'S SLIPPER. Flowers of the genus *Cypripedium*, of great beauty.

LADY'S TRESSES. Small orchideous plants of the genus *Neottia*, of no importance.

LÆVIS. Smooth.

LAGENÆFORM. Bottle-shaped.

LAGOON. A shallow lake, into which the sea flows.

LAGOPUS. The genus containing the grouse and similar birds feathered down to the toes.

LAIR. The resting-place of savage animals; sometimes used, also, for that of oxen and cows.

LAKES. Pigments obtained by throwing down the colouring matter of vegetable solutions by alum.

LAMB. For the farmer, late lambs dropped at grass time are best, as the ewe yields more milk: the teat of the ewe should be cleared of any tags that hinder suckling; if she does not own her lamb, put them together in a pen and place a little salt on the lamb; if she licks it, a good feeling will soon spring up. They are weaned at six to eight weeks; the rams are gelded at one to three weeks old. By killing lambs at six months, the wool becomes much more valuable. The young ewes should not be put to ram until two years.

LAMBDOIDAL SUTURE. The line of junction between the bone at the back of the head (occipital) and the side bones (parietal).

LAMB'S LETTUCE. Corn salad.

LAMB SKINS. Their value depends on the fineness, brightness, and colour of the wool, black being most esteemed. The skin is extensively employed in making gloves.

LAMELLÆ. The gills of mushrooms.

LAMELLICORNS. A division of pentamerous beetles, in which the short antennæ are inserted into a deep fossa at the side of the head: the body is ovoid and heavy; the anterior part of the head is commonly dilated, and projects; the mentum is large, covering the labrum or incorporated with it, and bearing the palpi. They are very numerous, feed on excrements, rotten wood, and roots.

LAMENESS. "In the horse it is brought on from various causes, sprains, over-exertion, diseases of the foot, &c. The muscles of the shoulder are occasionally sprained, and, in this case, the animal cannot lift his foot without great difficulty; indeed, he will be observed to drag his toe along the ground. In this case few local measures can be adopted. The horse should be bled from the vein on the inside of the arm, fomentations applied, and a dose of physic given. In this, as in most other cases of lameness, quiet and rest are essential to the restoration of the animal." See *Horse*

LAMINA. The flat surface of a leaf.

LAMINÆ. A tribe of longicorn beetles, distinguished by a vertical head, filiform palpi, antennæ bristly and simple, thorax nearly equal throughout: some species are apterous.

LAMINATED. Rolled or beaten to thin leaves or foil.

LAMPBLACK. Fine charcoal obtained by imperfectly burning resins, &c.

LAMPYRIDÆ. A family of soft-skinned, serricorn beetles, a portion of the females of which are phosphorescent.

LAMPYRINÆ. A tribe of soft-skinned, serricorn beetles, characterized by palpi with enlarged terminations, a soft, straight, slightly-depressed body, by the thorax projecting over the head, which it partially or wholly covers.

LANATE, LANATUS. Covered with wool, or having the appearance of wool.

LANCEOLATE. Lance-shaped, oblong, and gradually tapering to the ends.

LAND. In agriculture, the bed, or stitch, between two water furrows.

LANDSCAPE GARDENING. The art of laying out grounds: curved lines, clumps of trees, with a rich sward, and shrubberies, are the elements of landscapes; fences should be sunken so as not to interrupt the view, which should be opened as much as possible, unless unsightly; in the latter case, a clump or grove of trees may be made to hide the objects. Fountains, terraces, urns, and other objects of art, are introduced as ornaments. A winding stream is a necessary element of extensive grounds.—See *Loudon's Encyclopædia of Gardening*.

LANDSLIP, or LANDSLIDE. A quantity of land which has slidden down the side of a hill: it is caused by the undermining of water or by an earthquake.

LAND SPRINGS. Springs which only come into action after heavy rains: all springs owe their origin to rains. In the case of land springs, the water, when it sinks through the surface, is speedily interrupted by a retentive stratum of clay or rock, and there accumulating, soon bursts out into a spring, which ceases to flow a short period after the cause which gave it birth; but the water which supplies constant springs sinks deeper into the earth, and accumulates in rocky or gravelly strata, which become saturated with the fluid.

LANIARIES. *Dentes laniarii.* The dog teeth, or cuspidati, conical teeth at the sides of the jaws, next the incisors.

LANTANUM. A new metal found in *cerite*.

LAPIDEOUS. Like stone, hard.

LAPILLI. Small volcanic cinders.

LARCH. The European larch (*Larix communis*) is much cultivated in England for ship-building, bridges, dock gates, and other purposes. The timber is of remarkable excellence. It is a native of the Tyrol, and grows with great rapidity on the poorest soils and in very elevated positions. The bark is nearly as valuable as that of the oak for tanning, and the trunk, when tapped, yields the Venetian turpentine; there is also a sweet gum obtained from it called Briançon manna.

LARCH, AMERICAN. *Hackmatac.*

LARD. See *Hog's Lard.*

LARK. This genus of birds is granivorous.

LARKSPUR. The genus *Delphinium*, many of which have handsome blue flowers: these plants are diuretic and acrid. The *D. consolida* and *staphisagria* were formerly used in medicine.

LARVA. The caterpillar or maggot state of insect life; the young of some amphibious animals are also called larvæ.

LARVIPARA. Producing larvæ.

LARYNGOTOMY. The operation of making an opening into the larynx; this is sometimes necessary in cases of choking or severe inflammation, where the opening of the larynx, along which air passes, is closed.

LARYNX. The upper part of the windpipe, formed of cartilage, and lying at the root of the tongue.

LAST. A quantity, varying in different countries, and with respect to various articles. The following quantities generally make a last: 12 dozen of hides or skins; 12 barrels of meal; 10½ quarters of cole seed; 10 quarters of corn or rape seed (in some parts of England 21 quarters of corn go to a last); 12 sacks of wool; 1700 pounds of feathers or flax. 4000 pounds is often the amount of a last.

LATENT HEAT. Heat supposed to be present in all bodies, and on which their form depends; it cannot be felt, but, by a change in the form, is given out, and becomes sensible or free heat. Vapours and gases contain most, next fluids, and last solids; so that, by the abstraction of heat, vapours are condensed, fluids freeze, and, by the reverse, solids become fluid or gaseous.

LATERITIOUS (from *later*, a *brick*). A deposite of a reddish colour from urine, &c.

LATEX. The milky or elaborated juices of plants: it circulates in a peculiar arrangement of tubes called the *laticiferous* vessels, which anastamose over the plant.

LATH. A thin slip of wood, one fourth or three eighths of an inch thick, used in plastering, slating, &c.

LATHE. A machine for revolving pieces of wood, metal, &c., which are cut with different tools while rotating.

LATH FLOATED AND SET FAIR. In building, three-coat plasterer's work, in which the first is called pricking up, the second floating, the third, or finishing, is done with fine stuff.

LATH LAID AND SET. In building, two-coated plasterer's work, except that the first is called *laying*, and is executed without scratching, unless with a broom. When used on walls, this sort of work is generally coloured; when on ceilings, it is white.

LATHYRUS. A genus of handsome climbing, leguminous plants, much cultivated for ornament.

LATICIFEROUS VESSELS. Milk vessels; they carry the *latex*.

LAUDANUM. Opium dissolved in alcohol, tincture of opium.

LAUREL. Shrubs, or small trees, of the genus *Laurus;* several are evergreen: they yield aromatic resins and oils.

LAURINE. A fatty, acrid substance, found in the berries of the common laurel (*Laurus communis*).

LAVA. The molten mineral matter which has flowed from volcanoes; it is very porous.

LAVER. A sea-weed (*Porphyra laciniata* and *vulgaris*), eaten as a delicacy when boiled; sometimes green laver (*Ulva latissima*) is substituted.

LAVENDER. *Lavendula spica.* It grows on a poor, light soil, is propagated by slips and cuttings of the year's shoots; these are set in May, six inches apart, in a shady border, and transferred by October to the permanent beds, about two feet apart. The ground is stirred in spring, and the flowers gathered early in July; the beds, with a little care, last a long time. The flowers are distilled for their rich perfume, which is the principal ingredient of *eau de Cologne.*

LAWN. Ground covered with the smaller perennial grasses, kept short by mowing, and generally situated in front of a house or mansion. Lawns, when once established, require only to be kept neat by the ordinary routine of rolling, mowing, and sweeping, except keeping the surface perfectly even, by making up small hollows with screened mould early in spring. When lawns become worn out, a top-dressing of any finely-divided manure will refresh them; leached ashes are particularly useful, and, at the same time, an additional quantity of grass seed may be sown.

LAXATIVE. A gently-purging medicine.

LAXATOR. Any muscle which relaxes the tension of the part into which it is inserted.

LAX, LAXUS. Diffuse, loose.

LAY, LEY, LEA. A term applied to land in the state of grass or sward. This kind of ground is frequently distinguished into such as has been long in the state of sward, and such as is newly laid down to grass, or into old and new lays. An old lay, fallowed or turned under, yields an admirable preparation for potatoes, corn, wheat, and numerous other crops. The proper method of managing a new lay is of great importance to the farmer, which Young thought should be by keeping it perfectly free from stock for the following autumn and winter after being laid down, when, in the spring, it will afford a growth of young grass highly valuable for sheep, with which it should only be well stocked, and kept down then, and during the following summer; nothing, in his opinion, being more pernicious than mowing a new lay, as directed by certain authors, if it be intended for permanent meadow.

LAYERING. Propagation by *layers*, which are short branches of plants, trees, or shrubs. The layer is stripped of its lower leaves, a slit made under one of the central buds, and the branch twisted or the bark taken partially off, and then bent and pinned down in the soil by a wooden pin; the wounded portion is placed from two to six inches under the soil, and covered with fine mould and sand; the end of the branch is trimmed to one or two eyes above the soil; in a few weeks it will have thrown out roots, and may be cut away and transplanted at a suitable time elsewhere, being a new plant. It is a very safe method of propagation, and in some flower plants nearly the only one. It is practised in the summer and autumn, and on the year's shoots in many cases, but usually on two-year shoots. Plants so situated as to render it impossible to bend their branches to the ground, may nevertheless be layered by having shoots introduced into a pot or box of soil elevated to them, and supported in a convenient position. A piece of bass matting tied around the limb near a crotch may be made to sustain the soil. This is a common practice among the Chinese, who cause branches of trees to root in this manner by partially ringing them, and covering such parts with a ball of clay, which is kept moist.

LAYERS OF WOOD. The circular rings of wood or bark produced annually. The number of wood layers in a trunk gives us an idea of the age of the tree.

LEA. See *Lay*.

LEAD. A soft, inelastic, and ductile metal, fusing at 612° Fahrenheit: sp. gr., 11·44. Melted in open vessels, it absorbs oxygen, and becomes converted into massicot, which, being fused, is litharge, the protoxide of lead. The equivalent of lead is 103·73, symbol Pb (*Plumbum*). The metal, in the form of sheet, is very useful for covering buildings and forming gutters. From its softness, it is also adapted for pipes, which are quite flexible. Lead cisterns and pipes are objectionable as reservoirs for rain water. It is used as an alloy with other metals. Lead is readily soluble in nitric acid, and slowly in strong acetic and carbonic acids. Its most important compounds are the *carbonate* (white-lead) and *acetate* (sugar of lead).

LEAD, BLACK. Plumbago. A native carburet of iron.

LEAF. An expansion of cellular tissue and vessels appended to the stem at the nodes; it receives vessels from the new wood on the upper, and contributes them to the bark from the under surface. Along the upper channels the ascending sap flows, and the elaborated juices leave the leaf by the inferior system, descending between the new wood and bark, and organizing new wood for the next year and roots. Leaves are articulated, and fall off entire in exogenous plants, but are expansions of the bark, and not articulated in endogens; hence, when they die, the fragments remain, decaying in the air. The figures of leaves are innumerable, and furnish the principal means of recognising species of plants; they are also occasionally covered with hairs, glands, prickles, and, for the most part, with minute openings on the under surface, called *stomata*.

Physiologically, the leaf is not only the most important portion of a plant, but the only living portion; the trunk and roots are only fibres extended from the leaves: the fruit and seed are only modified leaves; they produce the buds of plants, the great means of propagation; hence, in the vegetable kingdom, more than half of the known plants are no more than a leaf, or foliaceous organ, as in ferns, lichens, sea-weeds, fungi, and mosses; and the leaf alone of many plants is capable of giving rise to a new individual, forming a root, a new bud, and ultimately the entire tree or plant; thus, the orange, water-cress, mint, hoya, clinanthus, and other species, have been *propagated by a leaf*. The planted leaf swells at its stalk, emits roots, and develops a bud.

A leaf is a porous or spongy body; the gases and fluids of the interior of the plant, and the gases and fluids of the air mingle together by chemical laws in its structure; *light*, acting on these, produces a change of composition, and establishes a movement. Out of carbonic acid gas and water, light, and the chemical actions of the leaf, evolve sugar, gum, starch, and wood; these principles, acted upon by other substances present, produce, in part, albumen, fibrin, oils, &c.; and thus, primarily in the leaf, all the products of vegetation are formed, and hence they become distributed throughout the whole plant.

The leaf only, with the green parts, can elaborate sap for the whole vegetable; the apparent changes in the ascending sap are an increased density, and the separation of oxygen and nitrogen gases, which escape into the air. Leaves are to be carefully preserved as the elaborating organs of the plant, out of which come growth and vigour.

LEAF BUD. The collection of small leaves with a central point capable of expansion, which is produced at the base or axil of the leaves. In the bark is laid up a deposite of food for their use in spring, upon which the bud, whether separated to another tree (in budding), or remaining in its native place, feeds while young; by its expansion, a shoot is formed. Leaf buds perpetuate all the peculiarities of the tree on which they originated.

LEAFLET. The lesser leaves of a compound leaf.

LEAF MANURE. The dead leaves of the forest constitute an admirable manure when rotted in the farm-yard, pig-stalls, or in composts; they have precisely the value of straw, being very similar in their action. The leaves of oaks and plants growing on a rich soil are better than those of pine, or such as grow on poor lands. They should be collected as early as possible in the fall. If ploughed into the soil directly, they form an excellent amendment, but require rather more time to yield vegetable food. In this case, lime should be applied with the leaves.

LEAF STALK. The petiole. Leaves destitute of stalk are called sessile.

LEAGUE. The sea league is the one twentieth of a degree, or 3·45 miles. The French posting league is 2·42 English miles.

LEAN-TO. A building whose rafters lean or pitch against the wall of another building.

LEASH. A line to couple dogs. Three head of game.

LEATHER. Skins of animals preserved by rendering their gelatin insoluble and impermeable to water; this is called *tanning*, when a solution of tannin is used, and the product becomes *tannogelatin*.

Tawed leather is formed by steeping prepared skins in potash liquor and a solution of common salt and alum; in this way the resulting salt of alumina combines with the gelatin: glove leather is so formed. Curried leather is smeared with oil while moist, which gradually penetrates the skin as it dries. A perfect hide of leather is tested by its section, which should be glistening and marbled, without any white streaks, but uniform and compact. See *Tanning*.

LEATHER WOOD. *Dirca palustris*. A small indigenous shrub with very flexible branches, and a tough, leathery bark.

LEAVEN. A piece of sour dough of flour or corn meal, used to make other dough light; it is well kneaded into it, and produces fermentation, but is altogether inferior to yeast.

LEDGERS. In building, the pieces of timber used in scaffolding which lie parallel to the wall, and horizontal.

LEECH. *Sanguisuga officinalis* and *medicinalis*. They inhabit shallow brooks and ponds, and are taken by driving a horse or other animal in; the leeches attach themselves to the legs. They are invaluable in relieving local inflammations by drawing off an excess of blood.

LEEK. *Allium porrum*. This is a biennial of the onion genus, but without heads; used in stews, broths, &c. The best variety is the large London. Leeks are obtained by seed, which is sown in a bed early in spring for the first supply, and in April for the crop. The seedlings are transplanted when six or eight inches high, being previously thinned and weeded, and set in rows ten inches apart, the rows being eight inches distant. The leeks are set deep in holes made by a dibble. The soil must be well watered and loosened. The after-treatment consists of hoeing and occasionally cutting away the tops of the leaves to increase the size of the root. The plants are used from June to winter. Seed is obtained by leaving some of the leeks in the seed-bed 8 inches apart, covering with straw in winter, and allowing them to flower in May. The seed cluster is to be cut when turned brown, and dried before being thrashed.

LEES. The dregs or refuse of fermented liquors: when rotted, they form good manure, and should, therefore, be put into the farm-yard or piggeries.

LEGHORN STRAW. It is derived from the straw of wheat In Tuscany, the long-awned spring wheat, called *marzolano*, is cultivated on the sandy hills of the Valley of the Arno. The seed is sown in March very thick, and the plants pulled when the spikes are formed, but before any grain: it is then eighteen inches tall. It is bleached by exposure to air like flax. The portion of straw between the ear and uppermost knot is all that is employed: this is selected, tied in bundles, and carried home. Before use, the straw is bleached by the vapour of sulphur, either in barrels or appropriate rooms; the plait is also bleached, and the bonnets are again bleached. English Leghorn is made from rye similarly managed. Both these plants yield better straw than that from grasses.

LEGUMEN, LEGUME. A pod like that of the pea, bean, &c. A one-celled, one or many seeded, two valved, superior, and commonly dehiscent fruit.

LEGUMIN. The casein of leguminous plants.

LEGUMINOSÆ. An extensive natural family, very important in agriculture, from yielding pease, beans, clovers, indigo, &c. The genera are often immense trees in the tropics, as logwood, mahogany, but are usually small herbs in the North. The most remarkable characters are the presence of legumens with irregular, often papilionaceous flowers.

LEGUMINOUS CROPS. Crops of clover, beans, tares, lucern, and other leguminosæ. Some writers, however, very improperly allude to root and leaf crops under this term, imagining that all ameliorating crops should be called leguminous, as being distinguished from white or culmiferous crops, which are also exhausters.

LEICESTER SHEEP. See *Sheep*.

LEMON. *Citrus medica*. A small tree, native of Asia, but extensively cultivated in tropical America and temperate climates free from heavy frosts. The citron, lemon, and lime are considered only varieties, notwithstanding their great difference in size and the sharpness of the juice. The tree can be cultivated in southern Florida, but requires an orangery northward.

LEMON, ESSENCE OF. The oil distilled from the peal, mixed with alcohol. The pure oil is termed the *oil of lemons*.

LEMON SIRUP. Lemon juice is kept with difficulty in bottles; made into a strong sirup, it is better preserved. The fluid sold by this name is only common sirup, acidulated with a little oil of vitriol.

LENITIVE. Medicines which gently soothe in diseases. A gentle purgative.

LENS. A thin solid, the faces of which are curved, and the general figure usually circular. The glasses of spectacles are lenses. Those lenses which have two convex or protuberant sides, or one side plane, magnify objects, and concentrate the rays of heat to a burning focus; hence they are termed magnifying or burning glasses. Concave lenses minify, and do not collect heat to a real *focus*. The name of the lens differs with the figure of the curved surface

LENTICULAR. Shaped like a double convex lens; thus ().

LENTICELLS, or LENTICULAR GLANDS. The small specks or knots on the stems of some trees, from whence, if in the soil, roots would proceed.

LENTIL. *Ervum lens* (*Fig.*). A

leguminous annual, similar to the vetch. It is much cultivated in France and some parts of Germany as food for man. The French have three varieties: the small brown, for soups, the yellowish, and the large Provence, with luxuriant straw, and which may be cultivated in the place of tares.

They are sown on a dry, warm, sandy soil, later than the pea, one to one and a half bushel to the acre, and afterward treated like pease, unless they be planted for horse provender, when the whole plant is cured, as in the case of tares. The yield is much less than from the latter crop. The lentil is as nutritious as the bean. It contains 22 per cent. of legumin (*casein*), 48·5 of starch, gum, and sugar, and 2·5 oil. Schwartz states the crop at 39¾ bushels, of 62¼ pounds each, to the acre.

LENTOR (from *lentus, clammy*). Viscidity, clamminess in fluids.

LEPIDOPTERA. Insects of the moth and butterfly tribe. See *Insects*.

LEPIDOTUS, LEPIDOTE (from *λεπις, a scale*). Scurfy, scaly. A botanical term.

LEPISMA. A family of wingless insects, the bodies of which are covered with glistening scales, the feet short. They are very active, and found about old wood, and in dark, mouldy places.

LEPRA, LEPROSY. A disease of the skin, which becomes rough and covered with scaly patches. Warm baths, sulphur, and, lastly, tar ointment, with proper attention to the health, are the best remedies.

LEPTURA. A genus of longicorn beetles, of the family *Lepturidæ*. "Head inclined posteriorly behind the eyes, or contracted at its junction with the thorax into a neck; thorax conical or trapezoid, narrowed anteriorly; elytra becoming gradually narrower; eyes rounded and entire, or, if emarginate, antennæ inserted before emargination."

LETHARGY. Drowsiness, morbid desire to sleep. It is sometimes a precursor of apoplexy, and calls for blood-letting if occurring in a full habit.

LETTUCE. *Lactuca sativa*. The varieties are very numerous; the most hardy are the large green head, cabbage, tennis ball, Egyptian green coss, larged green curled, and Madeira, which may be kept alive through winter if protected by a coating of straw: they are sown in September. Other esteemed spring kinds are the early Silesia, sugar loaf, Paris loaf coss, pale green, and a later sort, the large summer Silesia. Lettuces in this latitude require to be raised in slightly warmed beds. An ounce of seed produces upward of ten thousand plants. It should be sown very thin early in March, and transplanted when about one inch and a half high, as soon as the frost is out of the ground. The soil should be rich and fine, and the plants set a foot apart each way. They must be well watered after transplanting, for the lettuce is partial to moisture. The plant must be kept weeded and well worked, at least every fortnight; in this way they will head before hot weather, after which they usually run to seed without heading. The coss lettuces required to be blanched by tying up the leaves with a bass bandage. Seed plants are procured by allowing fine specimens to flower: the seed sown should be fresh, as it frequently loses its vegetating power after two years.

LETTUCE, LAMB'S. Corn salad.

LEVIGATION. The reduction of hard substances, by rubbing or trituration, to fine powder.

LEUCIN. A white, crystalline body like spermaceti, produced by the action of alkalies or sulphuric acid on protein: formula, $C_{12}\ H_{12}\ N\ O_4$.

LEUCITE. White Vesuvian garnet. It is abundant in some of the Vesuvian lavas, and contains upward of 23 per cent. potash, alumina 23, silica 54.

LEUCOL. One of the products of the distillation of coal tar.

LEUCOMA. Opacity of the cornea, which becomes whitish.

LEUCOPHLEGMATIC. A condition of the body in which the skin is pale and flabby.

LEVATOR MUSCLES. Those which raise a limb or part. They are situated in the front portions of the animal.

LEVEE. A provincial name for a large embankment.

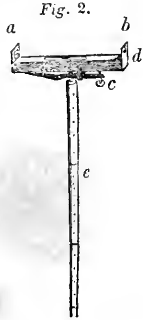
LEVEL. An instrument for ascertaining the level or the direction of a horizontal line. It is of great utility in drainage, building, and laying out grounds.

Levels in which the plumb-line forms the essential part are those most usually employed for the common purposes required by bricklayers, masons, carpenters, &c. They are constructed under many different forms, but the general principle is as follows: A frame or board is prepared, having one edge perfectly straight, and an upright line is drawn on the frame at right angles to the straight edge. To some point of this line a thread carrying a plummet is attached; consequently, when the frame is placed in such a position that the thread of the plummet, hanging freely, coincides with the upright line, the straight edge of the frame, which is at right angles, must be horizontal. See *Plummet*.

Spirit Level.—By far the most convenient and accurate level is the spirit level (*Fig.* 1), "which is nothing more than a glass tube nearly filled with spirit of wine, the bubble in which, when the tube is placed horizontally, would rest indifferently in any part, if the tube could be made mathematically straight; but that is impossible to execute, every tube having some slight curvature."

Fig. 1.

Fig. 2.



The spirit level in surveyors' instruments is fixed to a frame carrying a telescope or compass; *Figure* 2 represents a spirit level mounted on a staff, for common farm levelling.

"It is furnished with eyesights, *a b*, and when in use is placed into a framing of brass, which operates as a spring to adjust it to the level position, *d*, by the action of the large-headed brass screw, *c*. A stud is affixed to the framing, and pushed firmly into a gimlet-hole in the top of the short rod, *e*, which is pushed or driven into the ground at the spot from whence the level is desired to be ascertained. It need scarcely be mentioned that the height of the eye-sight from the ground is to be deducted from the height of observation.

Fig. 3 represents a useful and very simple form of level. "A slip of wood must be procured, measuring three inches broad by half an inch thick, and sixteen feet nine inches long, which must be cut into four lengths of five feet three inches, five feet, three feet three inches, and three feet three inches, marked as follows:

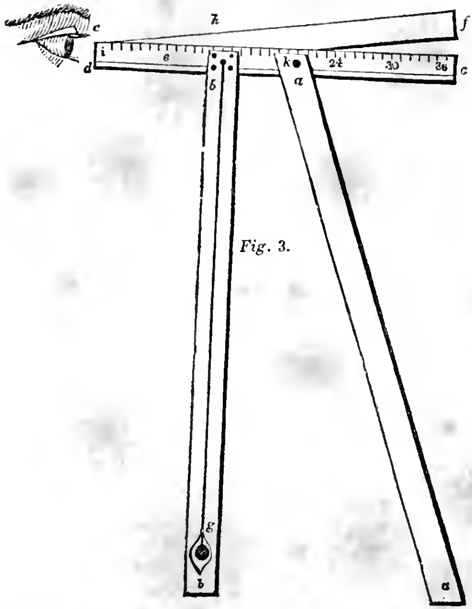


Fig. 3.

a a, five feet three inches; *b b*, five feet; *c d*, three feet three inches; *c f*, three feet three inches: six thick screw nails are also required, one inch long. Join *c d* and *e f* by a screw nail, inserted about two inches from the end of each, and exactly one inch from their upper surfaces. From the point *i*, upon *c f*, draw a line, measuring thirty-six inches, towards *f*, and exactly one inch distant from the upper surface, and divide this line into thirty-six parts or inches. It is self-evident that each of these points, when elevated above *c d*, will show a rise of one in fifteen, twenty, thirty-four, &c., as the case may be, provided *c d*, which should be divided into inches numbered on the upper edge, shall be horizontal; and *e f* shall point to a pole or mark as high above the ground as *c d* is; this is effected by fixing *b b* firmly upon *c d*, at right angles, and either having a plummet, *g*, suspended, as in the figure, or a spirit level fixed on the top of *c d*. I prefer the plummet made of bobbin or small cord, with a pierced bullet at the bottom. The instrument is retained in a level or horizontal position by the assistance of *a a*, which is upon a moveable pivot, made by one of the screw nails at *k*. The distance of *a a* from *b b* is immaterial. A small stop is fastened at the back of *b b*, for the purpose of preventing *e f* from falling below *c d*. The rise of a road is shown by looking from *e* towards *f*; the fall of a road, of course, by looking from *f* towards *e*, and, if great correctness is required, the observation should be reversed."

LEVELLING. The art of discovering the level of surfaces, or how high one place is above another; it also means, in agriculture, the reduction of hills or mounds to a level or plain surface, which is done by the plough, or the machine figured under the article *Barren Soil*.

The level set on a rod (*Fig.* 1) in the preceding article is all that is necessary for short distances; but telescopes are used in extensive surveys.

LEVELLING STAVES. Straight rods, six or more feet high, and divided into marks at the inches, which can be distinctly seen at a short distance; in more delicate observations the staff carries a moveable sight with a central mark, which is adjusted by an assistant, according to the signs of the surveyor, until the level line is reached.

LEVER. An inflexible bar capable of moving around a prop or fulcrum: the advantage, or leverage, gained depends on the distance at which the power acts from the prop, and weight or resistance. The lever is not only the simplest, but the only true mechanical power. Writers speak of levers of the first, second, and third kinds: in the first, the fulcrum is between the power and weight; in the second, the fulcrum is at one end and the power at the other, the weight being between them; in the third, the fulcrum and weight are at the ends, the power intermediate; in this case there is loss of power, but gain in the rapidity of movement of the weight: the treadle of a lathe is an instance.

LEVERAGE. The advantage gained in power by using a lever.

LEVERET. A young hare.

LEVIGATION. The reduction of a solid to an impalpable powder with the assistance of water or other fluids; this may be done in a mortar or on a slab; the mixture is afterward diffused in water, and the light parts, which remain suspended some seconds, poured off and retained, the heavier portions being again triturated.

LEY. Grass land.

LEYDEN JAR. See *Electricity*.

LIAS. An argillaceous limestone of the secondary rocks; abundant in Europe, but unknown in the United States.

LIBELLULINES. A tribe of neuropterous insects like the dragon-fly, which are found about water, and prey on other insects. The word *Libellula* designates a genus of this family.

LIBER. The innermost bark of trees.

LICE ON ANIMALS. Nearly all animals are subject to some of these parasites: they are produced from filth, confinement, herding with infested animals; the creatures affected become restless, rub themselves against posts, bite the accessible parts of their skin, and even become subject to skin diseases. The best remedies are, access to water, washing, combing, or currying the hide, anointing with sulphur, mercurial, or whale oil ointment; decoctions of tobacco, and other narcotic weeds, are also valuable.

LICE ON PLANTS. See *Aphides*.

LICHENIN. The starchy matter of lichens.

LICHENS. "Plants of a very low organization, which grow on the bark of trees or rocks, when they form a kind of incrustation, or upon the ground, when they consist of irregular lobes, parallel with the earth's surface. Occasionally, in all situations, they are found in a branched state; but their subdivisions are generally irregular, and without order. Their fructification consists of hard nuclei, called *shields*, which break through the upper surface of the *thallus*, or main substance of the lichen, are of a peculiar odour and texture, and contain the reproductive particles. Lichens abound in the cold and temperate parts of the world. The greater part are of no known use; but some, as the reindeer moss (*Cenomyce rangiferina*), the Iceland moss (*Cetraria Islandica*), and various species of *Gyrophora*, are capable of sustaining life, either in animals or man. The Iceland moss, when deprived of its bitterness by soaking in an alkali, and then boiling, becomes, indeed, a diet recommended to invalids. Others are used as tonic medicines, as *Variolaria faginea* and *Parmelia parietina*. Their principal use is, however, that of furnishing the dyer with brilliant colours; orchall, cudbear, and perolle, with many more, are thus employed."

LIFTING PUMP. See *Pump*.

LIGAMENTS. Elastic fibrous textures uniting the bones together.

LIGATURE. A bandage. In horticulture, bass is used chiefly for this purpose. In farriery, a ligature is a fine, strong thread of silk, with which blood-vessels, &c., are tied in operations.

LIGHT. An imponderable agent, emitted in great brilliancy by the sun: it travels in straight lines at the rate of 192,000 miles the second. The sun's light consists of seven different colours, red, orange, yellow, green, blue, indigo, violet, which, being united, make the white light: they may be separated by a prism of glass, or a coloured transparent body.

Light is a most important agent in the development of plants, the green colour of their herbage being produced by its action; it appears to be the yellow light that effects this result. Although mould, and some kinds of mushrooms, exist without light, the plants usually cultivated cannot exist without its presence; hence, few plants do well in the shade. The bending of stems towards the light is one of the most curious phenomena of vegetation; it seems to be produced by the blue and indigo rays.

A pencil of light is a small beam, the parts of which are divergent.

LIGHTNING. The discharge of electricity from immense surfaces of clouds; it may occur from one cloud to another, or to the earth; in the latter case, the highest points and the best conductors receive the stroke. Hence, rods of iron one inch or more thick, and rising four to ten feet above buildings, are used for protection; the upper ends should be beaten out into several points, and either gilded or covered with platina, and the lowest extremity buried in the earth several feet, or brought in contact with moisture; in cities, the iron or lead pipes circulating through the streets form a good point of attachment. In a large building several rods are wanted. Large trees are admirable conductors of lightning, but, as their bark is often torn off violently during the passage of the fluid, it is dangerous to take shelter near them.

LIGNEOUS (from *lignum, wood*). Wood-like.

LIGNIN. The pure fibre of wood divested of starch and other impurities; according to Payen, it consists of an investing or cellular matter, *cellulose*, $C_{12}\ H_{10}\ O_{10}$, isomeric with starch, the true internal matter, or lignin, being $C_{35}\ H_{24}\ O_{20}$. Fine linen from hemp or flax is insoluble in water, decays very slowly, and is converted into dextrine by the action of dilute sulphuric acid and heat, and finally into starch sugar.

LIGNIPERDOUS INSECTS. Those insects which bore into or otherwise destroy wood.

LIGNITE. A kind of partially-formed coal, in which the woody structure is distinct. It belongs to the secondary formations.

LIGULA. An appendage of the sheathing petioles of some grasses. The lower lip, or labrum, of insects.

LIGULATE. Shaped like a riband. The outer florets of some composite flowers are called ligulate.

LILAC. *Syringa vulgaris*. A beau

tiful ornamental shrub, readily propagated in a rich, light soil.

LILIACEÆ. A family of endogenous plants, remarkable for their brilliant flowers, including the lilies, hyacinths, tuberoses, &c. They are characterized by six petals, six stamens, superior ovary, anthers bursting inwardly.

LILIACEOUS. Flowers resembling the lily.

LILY. *Lilium.* Several species produce beautiful flowers. They are propagated by bulbs.

LILY, DAY. *Hemerocallis fulva.* This has been recommended as a herbage plant. It is perennial, stands the summer well, and cattle are very partial to the leaves. It yields abundantly.

LILY OF THE VALLEY. *Convallaria majalis.* Sheep and cattle browse on it. Propagated by parting the perennial root.

LILY, WATER. *Nymphea alba.* A beautiful ornament on ponds.

LILY, THE AMERICAN WATER. *Nelumbium luteum.* The sacred bean. It bears the largest flower in the Northern States. The beans are edible.

LILY, THE YELLOW WATER. *Nupar lutea.* Common in ditches and ponds, bearing a yellow flower.

LIMACIDÆ (from *limax, a slug*). The family of slugs and snails.

LIMB, LIMBUS. The flat or expanded portion of the petal.

LIME. The oxide of calcium; the latter is a brilliant white metal, known only as a chemical curiosity. Lime, from its great chemical activity, is unknown in nature, but always exists combined, chiefly with carbonic acid, as limestone, chalk, marl, or calcareous minerals. It is also combined with sulphuric acid (gypsum), phosphoric acid (bone earth), and silicic acid.

The base (quicklime) is separated from the carbonate by a white heat. It is white, caustic, soluble in 500 parts water; specific gravity, 2·3. The solution is powerfully alkaline, changing vegetable colours, and with an acrid taste. It is much used as a test in the laboratory. The equivalent of lime is 28·5, symbol Ca.

When a small quantity of water is added to the quicklime, it swells, cracks, becomes hot, falls into powder, and absorbs the fluid, combining with it, and forming slacked or hydrate of lime. This contains 24 per cent. water, and is highly caustic. If quicklime be exposed to the air, so as to become air slacked, it absorbs water and carbonic acid to the extent of 38 per cent., about one half becoming carbonate or mild lime, and the rest hydrate. This mixture is slightly caustic. Both the hydrate and air-slacked lime continue to absorb carbonic acid, and finally become altogether mild; but this is slower in the case of the hydrate. Lime, being an active base, combines readily with nearly every acid, forming a host of salts. Its presence in any solution is made known by the action of dilute sulphuric acid, which precipitates it as an insoluble white powder (gypsum).

LIME IN AGRICULTURE. It is the most important amendment used in farming, and is employed in the state of quicklime, water-slacked, and air-slacked lime, and in quantities depending upon the object in view.

Its uses may be enumerated as follows:

1st. It assists in pulverizing the soil, by acting chemically upon the silicates therein, dissolving out a portion of the silica, and liberating potash and soda. It is for this cause that heavy doses of lime tell so well on poor granitic soils. The quicklime is best for this purpose, ploughed in thoroughly to a depth of three inches. From 100 to 600 bushels the acre are used; wet, stiff lands, and those destitute of calcareous matter, requiring most. It should be applied upon a fallow of four to six months, and stirred three times. This large addition shows its effects for many years. It should be made to poor lands to bring them into tilth, or to destroy insects and weeds. Sandy soils should receive much less lime than stiff lands.

2d. Lime corrects injurious substances in the soil, as sulphate of iron, &c. For this purpose, a heavy dose is required.

3d. Lime breaks up or pulverizes stiff clays, improving their texture. For this purpose, a heavy dose of quicklime is most effective.

4th. It decomposes inert vegetable matter, as peat, roots, &c. The dose for this purpose may be less than above; 30 to 100 bushels will be enough, if lime has been previously employed; but on peat lands, well drained, much more is necessary.

5th. Lime is found in large quantities as an ingredient in leguminous plants, potatoes, and other roots; hence it may be added as a special manure to such plants, three or four bushels being placed in the manure used for them.

6th It hastens the decay of stable manure and putrescent substances, and may be sprinkled over them when ploughed into the soil, but not allowed to be added for any length of time to heaps of manure, for it drives off any ammonia already formed, and ultimately reduces the action of the dung. One bushel to three or four loads will be enough.

A first liming for improvement of barren lands may be heavy; but if afterward a dose of 20 bushels the acre be added every four or five years, it will save a very heavy addition for some time. Quicklime would be the best to add as an amendment, but it is difficult to handle, from its causticity, and must never be added to wet soils, lest it convert them into a hard mortar. On the whole, therefore, water-slacked lime is the most useful. Air-slacked lime is used as a top-dressing to meadows, the other being too caustic; it is also employed to kill and annoy insects, which it does without injury to the plant. It is also added, in doses of a half to one peck, to the roots of fruit-trees, worked into the soil. The best kind of lime for the former is that obtained from burned shells, the common limestone usually containing magnesia, which, in a caustic state, is injurious to vegetation, from the slowness with which it becomes mild, so that it injures the roots of plants long after the lime has become quite mild. The older limestones, and especially those of a bright white, crystalline appearance, form the best lime.

Lime is also much used in composts to pulverize inert vegetable matter, which it does very effectually, converting it in part into *humate of lime*; the action of the lime is similar to potash or soda, and termed by chemists *catalytic*, or predisposing.

Lime-water, and a cream of lime, made by mixing lime with water to the consistence of cream, are much used as a steep for seeds, and to wash the bark of trees, &c., to preserve them from insects; it is also supposed to preserve timber.

LIME-KILN. A rough furnace for burning limestone or shells into quicklime. It is usually of a circular figure, constructed of hard rock or bricks, arched below, and furnished with a moveable grate. The building is six or more feet across, and 15 to 20 feet high, the wall being nearly perpendicular. The limestone is broken into pieces of the size of half a brick, and thrown from above, mixed with half or one third part of wood or other fuel, according to the kind of stone used; this is most conveniently done when the kiln is erected against a steep hill, so that carts can approach near the mouth to throw in the charge. Before adding the charge, fuel is placed above the grate to enable the whole to be lighted; and fresh quantities of limestone, and wood or coal, are added as the first portions burn and settle down. In the common kiln the charge is allowed to burn out, and then drawn when cold by removing the lower grate; but in the best modern kilns the charge can be partly removed without allowing the fire to die out. Good stone yields about 56 per cent. of lime, but the impure kinds leave more. It should slack into a fine powder with water, or it is impure or imperfectly burned.

Shells and limestone, or marl, can be burned in mass by heaping them with fuel and leaving air passages, as in making charcoal.

LIME, MILD. Carbonate of lime, which possesses little of the action of burned lime. Quicklime returns to this condition in the soil after a time, depending upon the porousness of the earth and amount of vegetable matter it contains. Chalk is much used in England as an amendment; but with us the reduction of limestones to a powder would be much more expensive than beneficial. Marl answers this purpose when rich in calcareous matter; some sands and gravels are so rich in broken shells as to afford a good calcareous manure: 10 to 30 cart-loads are applied. Carbonate of lime is slowly soluble in water containing carbonic acid.

LIMESTONE, LIME ROCK. The best for agricultural purposes are the oldest crystalline rocks destitute of magnesia. Limestone formations appear from the earliest transition epoch, in which they constitute hard crystalline marbles, through the second, and into the tertiary period. They frequently form the richest lands when disintegrated, in consequence of the large amount of corals and organic remains they contain, which often yield two per cent. of bone earth: some of the finest wheat soils are of this kind. Calcareous rocks, sands, or gravels are of every colour and admixture; sometimes flinty, sandy; at others, aluminous; but if the carbonate of lime be in any quantity, they are readily recognised by adding a few drops of strong acid, which should produce an evolution of gas or effervescence.

LIME PLANT. The May apple is sometimes called by this name.

LIME-TREE. *Tilia Europea.* The linden, a tree of great beauty, often attaining 90 feet, and bearing a large amount of sweet flowers in spring, which constitute a favourite food of bees. It is propagated with great ease from suckers, layers, seed, and cuttings. The wood is soft, but used in turning, and forms a fine charcoal for gunpowder: the inner bark affords the best bass.

The linden has been for ages a favourite tree in parks, groves, and avenues of towns; it is very patient of trimming, and can be cut into arches and other figures. Several varieties, differing considerably in height, are known.

Michaux describes three species of American trees of the genus *Tilia:* the *alba*, *Americana*, or *bass wood*, and the *pubescens*, or downy; they are not of much economical value, the wood being soft and destructible.

The linden of Europe is frequently planted as an ornamental tree; in the Northern and Middle States, it is, however, extremely liable to the attacks of numerous insects and caterpillars, and requires much attention to be preserved from destruction. Numerous span and canker worms infest the young buds and foliage; the use of lime and tobacco washes, or smoke, might diminish the number of these enemies.

LINACEÆ. The family of plants to which flax belongs: they are remarkable for their mucilaginous seeds and tough fibres.

LINCHPIN. The pin at the end of the axletree to confine the wheel.

LINDEN. See *Lime-tree.*

LINEATE, LINEATUS, LINEAR. Used in describing leaves, &c., which are narrow and of the same width throughout.

LINEN. The cloth or texture spun from the fibres of flax.

LINE OF DIP. In geology, the inclination of strata from the horizontal line; it is estimated in angles, and the direction of the dip towards the point of the compass given.

LINES. In agriculture, these are of great use to mark out the straight direction of ditches, banks, hedges, &c. In gardening, drills, beds, borders, &c., are made by means of a line. It is usually rolled upon two sticks, which are pointed at the lower ends, and can be fixed into the ground.

LING. Common heath (*Calluna vulgaris*). It grows very abundantly on the barren hill-sides in England and Scotland; the woody stems make good brooms and fuel, and the seed nourish grouse and many small animals.

LINGUA. A tongue. In entomology, an organ placed within the labium, and serving the office of a tongue.

LINGUATE, LINGUATUS, LINGUIFORM. A thick leaf, &c., shaped like the human tongue.

LINIMENT (from *lino, I anoint*). In farriery, a semifluid ointment, or a soapy application to rub upon painful joints, sprains, tumours, &c. The term is also applied to spirituous and other stimulating applications for external use. Liniments are intended either to lubricate or to stimulate; but in either case they can only be regarded as topical applications, their influence not extending beyond the part to which they are applied. In some instances they are anodyne, and contain solutions of opium or camphor in oil.

Linseed oil and lime-water form an admirable liniment for burns. Hartshorn and sweet oil for tumours, to discuss them, or hinder suppuration. Liniments with soap, hartshorn, and camphor, or opium, for stiff and painful joints or sprains.

LINING. In building, any covering of an interior surface. The linings, for instance, or boxings of window-shutters, are the pieces forming the backs of the recesses into which the shutters are folded. In doorways, they are the facings on each side the aperture: to sashes, they are the vertical pieces parallel with the surface of the walls.

LINSEED. The seed of flax. It is used for the extraction of oil, for feeding cattle, and medicinal purposes. The method of raising the crop is detailed in the article on *Flax*. The composition of the seeds is by no means well known; they contain from 11 to 27 per cent. of oil, 22 per cent. of starch, gum, and mucilage; 10 of sugar, and six parts of albumen and fibrin. The oil is extracted by grinding and pressing; or grinding, heating by steam, and pressing, the hot-drawn oil being, on the whole, best for painters, &c. The produce of seed is variously estimated at from 10 to 30 bushels, according to the richness of the soil; the latter quantity will furnish 385 pounds of oil the acre, leaving 69 per cent. of cake or refuse after pressure. The bushel of seed weighs from 50 to 52 pounds, and yields a quarter of oil

The entire seed, when defective, is sometimes used as provender; it is exceedingly fattening, and in all respects strong food; but the meal and cake are better. The seed are also boiled or steeped in boiling water for the mucilage they afford; it is mixed with hay, and used at the rate of three pounds daily for an ox; rather less meal is necessary, but the refuse cake is more strengthening and economical.

LINSEED CAKE. The refuse of linseed after expression. According to Payen, it still contains 9 per cent. of fattening matters, and 5 2 per cent. nitrogen; equal to nearly 32 per cent. of albumen. 22 lbs. are equal, in nutritious value, with 100 of prime hay. It is, for the most part, used to fatten cattle; four or five pounds of the cake, broken into powder, and either boiled or steeped in hot water, are mixed along with hay and cut straw. The quantity of oil it contains renders it very fattening, at the same time that the albumen makes it strengthening. Some persons use linseed oil with hay and meal, adding a quart of oil to a bushel of bean, oat, or other meal.

LINSEED JELLY or MUCILAGE. This is made by boiling six quarts of water on one quart of the seed for ten minutes. It is of great use in the cough of animals, and forms a good provender for calves.

LINSEED MEAL. Ground lin seed.

LINSEED OIL. For commercial purposes it is nearly always hot-drawn. It forms a drying oil when boiled with white-lead or sugar of lead, and is much used by painters and others. It is an excellent purgative for cattle. Sheep and calves require 2 to 3 oz., oxen 16 oz., and horses 16 to 24 oz.; but castor oil, in smaller doses, is equally serviceable.

LINT. The staple of flax, hemp, and other textile plants. The scrapings from pieces of linen, of great use in dressing wounds and stopping slight hæmorrhages.

LINTEL. A horizontal timber or stone over a door, window, or other opening, which sustains the weight above.

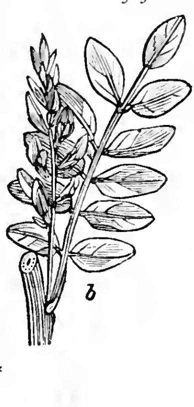
LIP. *Labellum.* In botany, the divisions of a monopetalous corolla, as the sage, mint, &c. It is divided into an upper and lower lip.

LIPPED AND HARLED. A wall built without mortar, but afterward having the joints filled with mortar, and the whole rough-cast or harled.

LIQUEFACTION. Melting, fusion, converting bodies into the fluid state, solution.

LIQUID MANURES. Manures applied in a soluble state, especially stable urine. A watering cart is used to diffuse it. They are especially of service to produce rapid growth in young plants, and serve for steeps. In very dry seasons manures may also be applied in this state; but when added any length of time before the plants there is a great loss by drainage; and the expense of application must always be heavy. The liquid soaked into peat, charcoal, &c., and added, as a top-dressing, during moist or wet weather, appears to be much preferred in the United States, and to be more economical. See *Urine.*

LIQUORICE. *Glycyrrhiza glabra*



(*Fig.*). Officinal liquorice. This is a leguminous herb, with perennial roots, which grow to a great length, and contain a peculiar sugar, with mucilage. The roots are used in coughs, or an extract, made by boiling, and called Spanish juice, liquorice, Pontefract lozenges, &c. It requires a deep sandy loam, and is best propagated from root slips containing an eye. The root is raised in the third year, in November, and sold fresh, or made into extract; the small roots are ground into powder. The expense of digging is considerable. A fair crop is 1800 to 2000 lbs. The root is extensively raised in Italy and Spain, to manufacture into the commercial extract (liquorice). It also grows well in England.

A species of *Glycyrrhiza* (*lepidota*) is indigenous to Missouri, and produces fair roots.

LIQUORICE SUGAR. See *Glycyrrhizine.*

LIQUORICE, WILD. *Galium circæzans.* The leaves have the taste of liquorice.

LIQUOR AMNIOS. The fluid surrounding the fœtus in its mother's womb. In botany, a fluid contained in the nucleus of the ovule, and supposed to nourish the embryo. It is absorbed during the ripening of the seed, sometimes leaving behind a delicate sack only.

LIQUOR AMMONIÆ. Solution of ammoniacal gas in water.

LIQUOR OF FLINTS. A solution of silicate of potash, made by fusing three parts carbonate of potash with one of sand.

LIRELLA. In lichens, a linear shield, with a furrow in the centre.

LITHARGE. An impure fused protoxide of lead. It is used for some plasters.

LITHIA. A rare alkali, resembling potash. It corrodes platinum.

LITHIUM. The metal of lithia; equiv. 10. Lithia is the protoxide.

LITHIC ACID. Uric acid.

LITHOLOGICAL (from λιθος, *a stone*, and λογος, *a discourse*). Relating to the structure, characters, &c., of minerals or stones.

LITHOMARGE. A kind of decomposed clay slate; sp. gr., 2·43: yellowish-gray or bluish, soft, adhesive to the tongue, greasy earthy, opaque, giving a shining streak. A variety consists of scaly, glimmering particles.

LITHONTRIPTICS (from λιθος, and τριβω, *I wear away*). Remedies which are supposed to dissolve stones in the bladder. Many bodies have been recommended for this purpose, but none have given remarkable results. An abundance of water acidulated with carbonic acid is the best.

LITHOTOMY (from λιθος, and τεμνω, *I cut*). The operation of cutting through the perinæum into the bladder to extract a stone.

LITHROTRITY (from λιθος, and τειρω, *I break down*). The operation of introducing an instrument into the bladder through the natural passage, to crush and break to small pieces a stone.

LITMUS. Turnsole. A blue colour prepared from a lichen (*Rocella tartarea*), and used in the arts (*archil*) and in chemistry. Solution of litmus, or paper stained thereby, is of great use in detecting any acidity in a fluid, the blue changing rapidly into red by the acid. Alkaline mixtures restore the paper so reddened. Both blue and reddened litmus paper are extensively used in the laboratory.

LITRE. The French standard measure of capacity in the decimal system. The litre is a cubic decimetre; that is, a cube, each of the sides of which are 3·937 inches; it contains 61·028 English cubic inches, and is, therefore, rather less than our quart. Four and a half litres are a close approach to the imperial gallon.

LITTER. The straw, weeds, or other dry substances which are placed under horses and cattle in the stables, cow-houses, farm-yards, piggeries, &c., for the purpose of keeping the animals clean and warm, and providing a supply of manure. In this last view, all sorts of dry materials should be carefully collected and stacked up for winter use.

LITTORAL, LITTORALIS (from *litus, the seashore*). Of the seashore Littoral formations, in geology, are such as have evidently been ancient sea beaches.

LIVE OAK. *Quercus virens*. Evergreen swamp oak of Florida.

LIVER. A large gland or viscus, placed, in quadrupeds, on the right side of the body, immediately under the chest, and adjoining the stomach It is saturated with blood-vessels, and separates the bile from blood. The bile is stored up in a small bag, called the gall-bladder, and thrown from hence, during digestion, into the small intestines, to be mixed with the chyme. The function of the liver is of the first consequence to health; but it is readily impaired, especially in damp, foggy places, subject to ague and bilious fevers. Its action, when insufficient, is rapidly stimulated by the use of calomel. Jaundice and yellowness of the white of the eye indicate disturbance of the liver.

LIVER OF SULPHUR. A brownish substance, of a fœtid smell. Fused sulphuret of potassium.

LIVERLEAF, LIVERWORT. *Hepatica Americana*. An herbaceous, perennial-rooted plant, of small size, found on the skirts of woodlands. A decoction is used in coughs.

LIVERWORTS. The plants resembling *Marcantia*, &c.

LIVE STOCK. The cattle, horses, sheep, and swine kept on the farm.

"The live stock on a farm must vary according to circumstances. The number of horses or oxen kept for the cultivation of the land and other farming operations should be exactly proportioned to the work to be done. If they are too few, none of the operations will be performed in their proper time, and the crops will suffer in consequence. If there are too many, the surplus, beyond what is strictly required, is maintained out of the profits of the farm. To have the exact number of animals which will give the greatest profit is one of the most important problems which a farmer has to solve; what may be very profitable in one case may be the reverse in another; and, as a general maxim, it may be laid down, that the fewer mouths he has to feed, unless they produce an evident profit, the less loss he is likely to incur. But this rule admits of many exceptions. It is of great importance, in taking a farm, to calculate the extent of the arable land, so that it can be properly cultivated by a certain number of pairs of horses or oxen. It is an old measure of land to divide it into so many ploughs; that is, so many portions which can be tilled with one plough each. When there are several of these, it is useful to have an odd horse over the usual number required for two or three ploughs, to relieve the others occasionally. The work is thus done more regularly and with greater ease. Where there are two ploughs, with two horses each, a fifth horse should be kept, and so in proportion for a greater number. The odd horse will always be found extremely useful, if not indispensable, and the expense of his keeping will be amply repaid by the regularity and ease with which the whole work of the farm will be done, and the relief which occasional rest will give to the other horses.

"The other part of the live stock kept on a farm must depend on various circumstances. Where there is good grazing land, the profit on the improvement of the live stock, or their produce, is evident and easily ascertained. But where animals are kept upon artificial food, or fatted in stalls, it is often a difficult question to answer whether there is a profit on their keep or not. In most cases, the manure which their dung and litter afford is the chief object for which they are kept. If manure could be obtained in sufficient quantities to recruit the land at a reasonable price, it might often be more advantageous to sell off all the hay and straw of a farm, and to keep only the cattle necessary to till the ground or supply the farmer's family; but this can only be the case in the immediate neighbourhood of large towns. In the country at a greater distance no manure can be purchased; it must, consequently, be produced on the farm; and for this purpose live stock must be kept, even at a loss. The management and feeding of live stock are, therefore, an important part of husbandry. The object of the farmer is, principally, to obtain manure for his land; and if he can do this, and at the same time gain something on the stock by which it is obtained, he greatly increases his profits. Hence much more skill has been displayed in the selection of profitable stock than in the improvement of tillage. Some men have made great profits by improving the breed of cattle and sheep, by selecting the animals which will fatten most readily, and by feeding them economically. It requires much experience and nice calculations to ascertain what stock is most profitable on different kinds of land and in various situations. Unless very minute accounts be kept, the result can never be exactly known. It is not always the beast which brings most money in the market that has been most profitable; and many an animal which has been praised and admired has caused a heavy loss to the feeder. Unless a man breeds the animals which are to be fatted, he must frequently buy and sell; and an accurate knowledge of the qualities of live stock, and their value, both lean and fat, is indispensable. However honest may be the salesman he may employ, he cannot expect him to feel the same interest in a purchase or sale, for which he is paid his commission, as the person whose profit or loss depends on a judicious selection and a good bargain. Every farmer, therefore, should endeavour to acquire a thorough knowledge of stock, and carefully attend all markets within his reach, to watch the fluctuation in the prices. It will generally be found that the principal profit in feeding stock is the manure; and to this the greatest attention should be directed. A little management will often greatly increase both the quantity and quality of this indispensable substance, and make all the difference between a loss and a profit in the keeping of stock."—(*W. L. Rham.*)

LIXIVIATION. The process of washing out the soluble from the insoluble portions of mineral substances, as in making lye; hence, *lixivium* means a lye or alkaline solution.

LIZARDS. *Lacertidæ, Lacertians.* These reptiles are perfectly harmless, and of great utility to the farmer from the insects which they devour.

LOAD. A vague measure; it is better understood when divided into one, two, or three horse loads. A single horse load is generally estimated at thirty bushels, one cubic yard, or one ton by weight.

LOAM. A very vague term, meaning a good soil, neither too light nor too stiff, and generally containing a large proportion of vegetable matter and clay. In Prof. Johnston's lectures, a loam is represented as a soil containing 30 to 60 per cent. of sand, the rest being clay, limestone, or vegetable matter: a clay loam contains but 20 to 30 per cent. sand, and a sandy loam upward of 60 per cent. sand. This word is often improperly written *loom*, and applied to a friable rich soil, containing much decaying vegetable matter.

LOBBY. An anteroom or hall.

LOBATE, LOBED. Divided into large curved segments more or less circular.

LOBELIA. A genus of plants containing many very poisonous species, as the Indian tobacco (*L. inflata*), which is of use in asthmas, and as an emetic. They are pretty herbaceous plants, with perennial roots, and often cultivated for their beauty.

LOBLOLLY BAY, or HOLLY BAY. *Gordonia lasianthus.* A large Southern evergreen found growing in swamps, producing large white flowers. The wood is rosy, but light and brittle; the bark is extensively used in tanning in the Southeastern States. It very much resembles the magnolia.

LOBLOLLY PINE. The old field pine (*Pinus tæda*).

LOCKED JAW. *Tetanus, trismus.* A consequence of injuries about the feet, worms, or severe nervous diseases; the muscles become rigid, and finally locked jaw supervenes. When it arises from a wound or laceration, the case is usually hopeless; when it is a disease (*tetanus*), large doses of opium are found to do most good, with the removal of all causes of irritation. The strength must be sustained by injections of broths and soups.

LOCKING WHEELS. Hindering the rolling of one or more wheels in descending steep hills. It is done by fastening a chain from the body of the wagon to the spokes of the wheel, or by levers or a drag.

LOCOMOTION (from *loci motio*). Change of place.

LOCULAR (from *locus, a place*). A cell or division in a fruit; thus, fruits are unilocular, bilocular, &c.

LOCULICIDAL. A term designating the bursting (dehiscence) of a seed vessel along the back suture.

LOCUSTA. The inflorescence resembling the spike, but occurring in grasses, the flowers having no calyces, but bracts only.

LOCUST BORER. *Clytus pictus.* Found on the trees in September; it is velvet black, adorned with transverse yellow bands; the eggs are snow-white, and deposited in the crevices of the bark: the grubs are soon hatched, and bore into the tender wood, where they commit great havoc until the next year. Whitewashing, washing with whale oil soap solution, spirits of turpentine, and catching the beetles, are to be adopted as preventives, otherwise the trees are rapidly killed by these borers.

LOCUST, HONEY. See *Honey Locust.*

LOCUSTS. *Cicadeæ.* Insects of the grasshopper family. The perfect insects are very short-lived, but the larvæ are long-lived; one species (*Cicada septendecim*) existing in that state in the earth for seventeen years or thereabout. The perfect insect bores the young twigs of trees to deposite its eggs, and thereby does much mischief to orchards and forests. The harvest, or dry fly, is the *C. canicularis.*

These locusts are in no way similar to the destructive insects which occasionally devastate the east shores of the Mediterranean and Southern Europe (*Gryllus* (*acrydium*) *migratorius*), producing famine from their ravages on the grain crops, and pestilence by the decay of their bodies. The immense numbers of this large grasshopper which move forward over whole nations is almost incredible; they appear like dense black clouds, sometimes hundreds of miles in extent, and emit, during flight, a loud, sharp noise.

LOCUST-TREE. *Robinia pseudacacia.* Sometimes improperly called the *Acacia.* This is a highly ornamental tree of the leguminous family, and of rapid growth while small. The seeds are usually rather imperfect, and the safest method of propagation is by suckers obtained from trees cut down, the soil being ploughed for the purpose of dividing the roots. The seeds propagate more certainly if immersed in boiling water before planting.—(*Bard*). The following particulars from Dr. Ackerly may be acceptable:

"I was led to admire Judge Mitchell's nursery of young locust-trees, planted in the spring.

"The judge took a quantity of seed collected on Long Island, and put it in an earthen pitcher, and poured upon it water near to boiling. This he let stand for twenty-four hours, and then decanted it, and selected all the seeds that were any ways swelled by this application of heat and moisture. To the remainder he made a second libation of hot water, and let it remain also twenty-four hours, and then made a second selection of the swelled seeds. This was repeated a third time on the unchanged ones, when nearly all were swelled, and then he prepared the ground and planted them. He planted the seeds in drills about four feet apart, and in eight or ten days they were all above ground, and came up as regular as beans, or any other seeds that are cultivated in gardens. When I saw them, the middle of July, they were about a foot high, all thrifty, and of a good colour and condition.

"It is the judge's intention to leave them in their present situation about three years, and then transplant; and provided he does not mutilate the roots in removing them, they will bear transplanting, live, and thrive, and be the most productive forest-tree that a farm can have. This method of preparing the seeds and planting the locust cannot be too warmly recommended to the farming interest. On Long Island, where fencing timber is growing scarce, the cultivation of the locust-tree is of great moment. In the centre of the island, on and about Hempstead plains, where there is no timber at all, it must be a most valuable acquisition; and from the trials made in raising it from the seed, all difficulty must be removed to its extensive cultivation.

"After this account was written, Judge Mitchell transplanted the young trees referred to on a side hill of waste ground, which had lain for many years uncultivated, and his farm was soon improved by the addition of a large grove of valuable locust-trees in the most thrifty condition.

"When planted out from the nursery the young trees must be protected from cattle, which are fond of the buds."

The locust yields a timber of great solidity and durability; it is also remarkably tough, and resists the action of moisture; hence it is of great value for posts, piles, and shipping. It is somewhat cultivated, and promises, on the prairies, to become extended for its utility for fencing, fuel, and rapid growth. In the northeast, it has been much injured of late by the borer. Besides the borer, the leaves of the tree are sometimes stripped by the ravages of a large green caterpillar, the larva of the *Eudamus tityrus:* the perfect insect is seen among the flowers.

LODGE. A small house situated in a domain; the house at the entrance to a park.

LODICULA. The two minute fleshy hypogynous scales beneath the ovary of grasses.

LOESS. Alluvial formations. By the English it is often used for a yellow loam, with chalky concretions.

LOG. A portion of the trunk of a tree.

LOGWOOD. *Hæmatoxylon Campeachianum.* A small leguminous tree of Central America and the tropics. The central heart wood, deeply stained, from old trees is preferred: the logwood bath is of great service in the production of black dyes, browns, and reds.

LOLIUM. The generic name of rye grass. See *Grasses.*

LOMENTUM. An indehiscent pod resembling a legume, but divided by membranes between each seed.

LONG-HORNED CATTLE. "A breed of neat cattle now nearly extinct, chiefly distinguished by the length of the horn, the thickness and firm texture of the hide, the length and closeness of the hair, the large size of the hoof, and the coarse, leathery thickness of the neck."—(*Johnson.*)

LONGICORNS, LONGICORNES. Coleopterous insects with long antennæ, often longer than the body: they are borers.

LONGIPALPS, LONGIPALPI. A family of short-winged beetles, with the maxillary feelers (*palpi*) almost as long as the head.

LONG MANURE. Unfermented dung and straw.

LOOM. A corruption of *loam,* which see.

LOOPERS. Caterpillars of the family *Geometers:* span worms.

LOOSENESS. Excessive discharge from the bowels, flux, diarrhœa. See *Ox, Horse;* and for the remedies, *Pharmacopœia.*

LOOSESTRIFE. Small weeds of the genus *Lysimachia;* they are wholesome. The creeping loosestrife, or money wort (*L. nummularia*), is said to be a good remedy against insects, when steeped in oil and sprinkled over the granary floor.

LOPPED MILK. Sour, curdled milk.

LOPPING TREES. The removal of the lateral branches for profit. The lop of a timber-tree is a subject of bargain with the purchaser.

LORE (from *lorum, a strap*). In ornithology, the space between the bill and the eye, which is bare in some birds, as the great crested grebe, but is generally covered with feathers. In entomology the term is applied to a corneous angular machine observable in the mouth of some insects, upon the intermediate angle of which the mentum sits, and on the lateral ones the cardines of the maxillare, and by means of which the trophi are pushed forth or retracted, as in the hymenopterous insects.

LOTION. An external wash: it may be evaporating (spirituous) or watery. Indolent sores require stimulating lotions; painful wounds, anodyne lotions, &c. Lotions are also used to discuss tumours and inflammations near the skin.

LOUSINESS. "An affection of the skin, arising, in cattle, from the irritation of lice or animalculæ, which may be distinguished by the naked eye. Most animals, and even insects, are subject to this annoyance. Lousiness in live stock is produced by neglect and low keep. The best remedy is more attention to cleanliness, with better food. The lice may be killed by a dressing applied with a brush to the chiefly affected parts, composed of four ounces of black sulphur, mixed with a pint of train oil, or a small portion of weak mercurial ointment."

LOUSEWORT. *Pedicularis Canadensis.* An insignificant perennial, herbaceous weed: the rattle.

LOVAGE. *Ligusticum levisticum.* A perennial (biennial), herbaceous, disagreeable aromatic plant, of the family *Umbelliferæ,* the seeds of which are used as medicine in flatulence. The seeds grow anywhere on a dry, light soil.

LOVE APPLE. Tomato.

LOVE GRASS. A small grass, ornamental, with pretty spikelets. *Eragrostis.*

LOY. A narrow spade.

LUBRICATION. Anointing with grease and oils.

LUCAMA. A Chilian fruit resembling, in size and flavour, a peach.

LUCANIDÆ, LUCANINES. A family of coleopterous lamellicorn insects, of the stag beetle kind (*Lucanus*).

LUCERN. *Medicago sativa* (*Fig.*).

Grand trefoil, French clover, alfalfa, Brazilian clover. A perennial, herbaceous forage plant of the clover family. It forms a very long, vigorous root, and requires a deep, rich soil, with some lime, for cultivation. It is often cut, year by year, for six and ten years, and yields, in three cuttings each season, from six to eight tons of excellent fodder, equal to the best clover. An acre soiled will supply three to four cows during the season. It grows eighteen to thirty inches high, and bears a purple flower, and possesses all the good qualities of clover in addition to its preference for a dry, warm climate. Fifteen to twenty pounds of seed are sown broad-cast, with a few oats, early in spring; but the lucern does not reach perfection until the third year; the land must therefore be harrowed and rolled to keep down weeds. It is not quite as hardy as clover. The varieties of lucern are unimportant. The seed is collected and hay made in the same manner as with clover; but it is best for soiling cut always when the flowers first show, as the stems become rigid. Sometimes the seed is drilled in rows, at nine inches apart, and in this way sooner comes to perfection, and less seed is wanted. Like clover, it is much benefited by plaster of Paris and lime. It will grow even in tropical countries which are not too parched. On lands where it is fully established, the soil should be forked twice a year, after cutting, and a top-dressing applied every second or third season: it must never be depastured; eighty pounds per day of fresh lucern is enough for a cow, and produces an abundance of milk.

LUCERN, ASHES OF. One hundred pounds green yield 2·58 pounds, and one hundred pounds dried 9·55 pounds, consisting of

	Sprengel.
Potash	13·40
Soda	6·15
Lime	48·31
Magnesia	3·48
Phosphoric acid	13·07
Sulphuric acid	4·04
Chlorin	3·18
Silica	3·30
Iron, alumina, &c.	0·60
	95·53

From this we see why gypsum, lime, marl, and ashes are so serviceable to lucern. Bone-dust and salt are also to be considered as manures for it.

LUG. A pole of land, 16½ feet; a vulgar term for the ear of animals.

LUMBAR, LUMBALIS. Belonging to the loins.

LUMBER. Timber, especially in the rough state.

LUMBRICUS. The generic name of worms resembling the earth worm; some species infest the bodies of animals. The earth worm, when not too numerous, tend to improve the soil by their castings; when over numerous, they eat the roots of plants, and may be destroyed by a heavy salting (twenty bushels to the acre), or liming, with a summer fallow.

LUNAR CAUSTIC, LUNAR CORNEA. Prepared nitrate of silver, sold in thin cylinders, and used as a caustic: it is one of the best caustics. A solution is very valuable as a lotion in some forms of inflammation.

LUNATE (from *luna, the moon*). Crescent-shaped.

LUNATION. The period from one new moon to another, the synodic revolution.

LUNGS. The viscus in which air is received, and the blood changed by its presence. The lights, pulmonary apparatus. The substance of the lungs resembles a fine regular sponge; they are so light as to float on water; the windpipe communicates with every cell throughout the viscus. Common air received is changed in the lungs by an absorption of four per cent. of oxygen and the substitution of an equivalent of carbonic acid, derived from the blood. This oxygenation, or aeration of the blood, taking place in the lungs, is one of the great functions on which life depends, and cannot be interrupted for a minute without injury or death. By this change, black venous blood is changed into the scarlet arterial fluid, which alone is capable of sustaining the wants of the body.

LUNGWORT. *Pulmonaria officinalis.* An exotic, perennial, herbaceous plant. The whole genus are pretty flowers, and readily propagated by seeds.

LUNULATE. Crescent-shaped.

LUPINE. *Lupinus albus.* An annual leguminous herb (*Fig.*), cultiva-

ted in Italy and France to a limited extent for forage and soiling. The seeds are as large as a pea, and very nutritious: they were used as food by the Romans. It grows on poor, dry, light soils, but is finest on rich loams; the seeds are sown as soon as frost is out of the ground, and the plants blossom in May and June. It is principally raised as a green fallow crop, and ploughed in just before the second flowering. Plants for seed must be mowed when moist, as the pods very readily burst. The lupin is considered inferior to other legumens as fodder, but is valuable for fallows, from growing on very poor lands, which it rapidly enriches. For this purpose, there is no doubt the common wild blue lupin (*L. perennis*), turned in the first season, would answer equally well.

LUPININE. A gummy matter of lupins. *Lupinite*, a bitter substance extracted from the leaves of the lupine.

LUPULINE. The yellow resinous dust hanging about the scales of the hop, on which its flavour and value depend.

LURCHER. A coursing dog, of the greyhound tribe, with a shaggy coat and pricked ears; it is very swift and sagacious.

LURID, LURIDUS. A colour of a pale-yellowish purple, frequently associated with poisonous properties in mushrooms and flowers.

LUSUS NATURÆ. A sport of Nature. Unnatural form in animals.

LUTE (from *lutum, clay*). In chemistry, pasty matter, used to adapt two vessels, or coat their surfaces from fire. Clay, putty, dough, lime, white of eggs, and melted India rubber are variously used.

LUTEOLINE. A yellow crystalline colouring matter of weld.

LUTESCENT (from *luteus, yellow*). Yellowish.

LUXATION. A dislocation of a joint.

LYCOPERDON. The genus of puff-ball mushrooms.

LYCOPODIACEÆ. A family of cryptogamic plants, growing in moist places, and resembling ferns, but with a higher organization, approaching that of the *Coniferæ*, or pine-trees.

LYCOSA. A genus of spiders dwelling in holes on the ground, or in chinks, and pursuing their prey with great activity. The tarantula is of this kind.

LYE. A fluid saturated with potash or other salts.

LYME GRASS. See *Elymus*.

LYMPH. The fluid of the lymphatic vessels. It is slightly milky, but becomes pink on exposure to air, and divides into a clot and fluid part. It is the surplus nutritious fluid returned from every part of the body to the blood through the thoraric duct.

LYMPHATIC GLANDS. In anatomy, small masses formed of contorted lymphatics, found in the groin, axilla, mesentery, &c.

LYMPHATIC HAIRS. In botany, the transparent hairs on some leaves.

LYMPHATIC VESSELS. Minute transparent tubes, found in every part of the body, and discharging their lymph into the thoracic duct.

LYRATE, LYRATUS. A leaf which is pinnatifid, but with segments larger at the extremity than the foot stalk.

M.

MACARONI. The dough of some fine wheats drawn out into tubes.

MACE. The envelope (*arillus*) of the nutmeg. It is of a pleasant aromatic flavour, and contains much butyraceous oil.

MACERATION. The softening of animal or vegetable bodies by immersion in fluids, either water, alcohol, ether, &c.

MACHICOLATED. With parapets projecting beyond the walls, and supported by arches springing from corbels or consoles.

MACHINE. In a general sense this word signifies anything which serves to increase or regulate the effect of a given force. Machines are either *simple* or *compound*. The simple machines are usually reckoned six in number; namely, the lever, the wheel and axle, the pulley, the wedge, the screw, and the funicular or rope machine. Compound machines are formed by combining two or more simple machines.

MACLAURA. *Maclaura aurantica.* See *Osage Orange*.

MACLE. Dark or black spots in minerals, supposed to arise from interruption in crystallization.

MACULATE, MACULATUS (from *macula, a spot*). Spotted.

MADDER. *Rubia tinctorum* (*Fig*).

An herbaceous perennial of the family *Rubiaceæ*. The following account of its culture by Mr. Bateham is the plan pursued for five years by Mr. Swift, of Erie county, Ohio:

"*Soil and Preparation.*—The soil should be a deep, rich, sandy loam, free from weeds, roots, stones, &c., and containing a good portion of vegetable earth. Alluvial land is the most suitable; but it must not be wet. If old upland is used, it should receive a heavy coating of vegetable earth (from decayed wood and leaves). The land should be ploughed very deep in the fall, and early in spring apply about one hundred loads of well-rotted manure per acre, spread evenly, and ploughed in deeply; then harrow till quite fine and free from lumps. Next, plough the land into beds four feet wide, leaving alleys between three feet wide; then harrow the beds with a fine, light harrow, or rake them by hand, so as to leave them smooth and even with the alleys: they are then ready for planting.

"*Preparing Sets and Planting.*—Madder sets, or seed roots, are best selected when the crop is dug in the fall. The horizontal uppermost roots (with eyes) are the kind to be used; these should be separated from the bottom roots, and buried in sand, in a cellar or pit. If not done in the fall, the sets may be dug early in the spring, before they begin to sprout. They should be cut or broken into pieces, containing from two to five eyes each, *i. e.*, three to four inches long. The time for planting is as early in spring as the ground can be got in good order and severe frosts are over, which, in this climate, is usually about the middle of April. With the beds prepared as directed, stretch a line lengthwise the bed, and with the corner of a hoe make a drill two inches deep along each edge and down the middle, so as to give three rows to each bed, about two feet apart. Into these drills drop the sets, ten inches apart, covering them two inches deep. Eight or ten bushels of sets are requisite for an acre.

"*After Culture.*—As soon as the madder plants can be seen, the ground should be carefully hoed, so as to destroy the weeds and not injure the plants; and the hoeing and weeding must be repeated as often as weeds make their appearance. If any of the sets have failed to grow, the vacancies should be filled by taking up parts of the strongest roots and transplanting them; this is best done in June. As soon as the madder plants are ten or twelve inches high, the tops are to be bent down on to the surface of the ground, and all except the tip end covered with earth shovelled from the middle of the alleys. Bend the shoots outward and inward, in every direction, so as in time to fill all the vacant space on the beds, and about one foot on each side. After the first time covering, repeat the weeding when necessary, and run a single horse plough through the alleys several times to keep the earth clean and mellow. As soon as the plants again become ten or twelve inches high, bend down and cover them as before, repeating the operation as often as necessary, which is commonly three times the first season. The last time may be as late as September, or later if no frosts occur. By covering the tops in this manner, they change to roots, and the design is to fill the ground as full of roots as possible. When the vacant spaces are all full, there will be but little chance for weeds to grow; but all that appear must be pulled out.

"The second year keep the beds free from weeds; plough the alleys and cover the tops, as before directed, two or three times during the season. The alleys will now form deep and narrow ditches, and if it becomes difficult to obtain good earth for covering the tops, that operation may be omitted after the second time this season. Care should be taken, when covering the tops, to keep the edges of the beds as high as the middle, otherwise the water from heavy showers will run off, and the crop suffer from drought.

"The third year very little labour or attention is required. The plants will now cover the whole ground. If any weeds are seen, they must be pulled out, otherwise their roots will cause trouble when harvesting the madder. The crop is sometimes dug the third year; and if the soil and cultivation have been good, and the seasons warm and favourable, the madder will be of good quality; but generally it is much better in quality, and more in quantity, when left until the fourth year.

"*Digging and Harvesting.*—This should be done between the 20th of August and the 20th of September. Take a sharp shovel or shovels, and cut off and remove the tops, with half an inch of the surface of the earth; then take a plough of the largest size, with a sharp coulter and a double team, and plough a furrow outward, beam deep, around the edge of the bed; stir the earth with forks, and carefully pick out all the roots, removing the earth from the bottom of the furrow; then plough another furrow beam deep, as before, and pick over and remove the earth in the same manner; thus proceeding until the whole is completed.

" *Washing and Drying.*—As soon as possible after digging, take the roots to some running stream to be washed. If there is no running stream convenient, it can be done at a pump. Take large, round sieves, 2½ or 3 feet in diameter, with the wire about as fine as wheat sieves; or if these cannot be had, get from a hardware store sufficient screen-wire of the right fineness, and make frames or boxes about two and a half feet long and the width of the wire, on the bottom of which nail the wire. In these sieves or boxes, put half a bushel of roots at a time, and stir them about in the water, pulling the bunches apart so as to wash them clean; then, having a platform at hand, lay them on it to dry. (To make the platform, take two or three common boards, so as to be about four feet in width, and nail cleets across the under side.) On these spread the roots about two inches thick for drying in the sun. Carry the platforms to a convenient place, not far from the house, and place them side by side, in rows east and west, and with their ends north and south, leaving room to walk between the rows. Elevate the south ends of the platforms about eighteen inches, and the north ends about six inches from the ground, putting poles or sticks to support them: this will greatly facilitate drying. After the second or third day drying, the madder must be protected from the dews at night, and from rain, by placing the platforms one upon another to a convenient height, and covering the uppermost one with boards. Spread them out again in the morning, or as soon as danger is over. Five or six days of ordinarily fine weather will dry the madder sufficiently, when it may be put away till it is convenient to kiln-dry and grind it.

" *Kiln-drying.*—The size and mode of constructing the kiln may be varied to suit circumstances. The following is a very cheap plan, and sufficient to dry one ton of roots at a time: Place four strong posts in the ground, twelve feet apart one way, and eighteen the other; the front two fourteen feet high, and the others eighteen; put girts across the bottom, middle, and top, and nail boards perpendicularly on the outside as for a common barn. The boards must be well seasoned, and all cracks or holes should be plastered or otherwise stopped up. Make a shed-roof of common boards. In the inside, put upright standards about five feet apart, with cross-pieces to support the scaffolding. The first cross-pieces to be four feet from the floor, the next two feet higher, and so on to the top. On these cross-pieces lay small poles about six feet long and two inches thick, four or five inches apart. On these scaffolds the madder is to be spread nine inches thick. A floor is laid at the bottom to keep all dry and clean. When the kiln is filled, take six or eight small kettles or hand-furnaces, and place them four or five feet apart on the floor (first securing it from fire with bricks or stones), and make fires in them with charcoal, being careful not to make any of the fires so large as to scorch the madder over them. A person must be in constant attendance to watch and replenish the fires. The heat will ascend through the whole, and in ten or twelve hours it will all be sufficiently dried, which is known by its becoming brittle like pipe-stems.

" *Breaking and Grinding.*—Immediately after being dried, the madder must be taken to the barn and thrashed with flails, or broken by machinery (a mill might easily be constructed for this purpose), so that it will feed in a common grist mill. If it is not broken and ground immediately, it will gather dampness, so as to prevent its grinding freely. Any common grist mill can grind madder properly. When ground finely it is fit for use, and may be packed in barrels like flour for market.

" *Amount and Value of Product,* &c.

—Mr. Swift measured off a part of his ground, and carefully weighed the product when dried, which he found to be over two thousand pounds per acre, notwithstanding the seasons were mostly very dry and unfavourable. With his present knowledge of the business, he is confident that he can obtain at least three thousand pounds per acre, which is said to be more than is often obtained in Germany. The whole amount of labour he estimates at from eighty to one hundred days' work per acre. The value of the crop, at the usual wholesale price (about fifteen cents per pound), is from three hundred to four hundred dollars. In foreign countries it is customary to make several qualities of the madder, which is done by sorting the roots; but as only one quality is required for the western market, Mr. Swift makes but one, and that is found superior to most of the imported, and finds a ready sale."

The presence of calcareous matter in the soil is an essential to the production of good dyeing madder.

Madder is used in dyeing numerous colours, as black, blue, red, olives, and buffs, and alone forms the rich Turkey reds. It contains several colouring principles, the chief of which is, however, *Alizarine*, an insoluble crystalline, bright red body.

MADDER, FIELD. *Sherardia arvensis*. An insignificant weed.

MADDER, WILD. *Rubia peregrina*. It yields an inferior madder root.

MADEIRA CIDER. Mix new cider with honey until it bears an egg; boil in a copper for one quarter of an hour, skim, cool, barrel, and bottle in March. It will be as strong as Madeira wine in six months.

MADEIRA NUT. The walnut.

MADIA. *Madia sativa*, sometimes called *Gold of Pleasure*, which see. A composite plant inhabiting South America, the seeds of which yield an abundance of good table oil. Boussingault obtained 41 per cent. in an analysis, and 26¼ per cent. by the common press. It is extensively cultivated in Germany, is a summer crop, maturing in 127 days from seed in Alsace, and yielding 2500 pounds of seeds per acre, or 635 oil, and 1700 of excellent oil-cake for fattening stock. The soil should be rich and in good tilth, and the seeds sown in drills in spring, and the young plants kept clean from weeds.

MAGMA. A thick fluid, or mud. Thick, feculent matters from solutions.

MAGGOT. The larva of dipterous and other insects. The fly in sheep.

MAGNESIA. An alkaline earth, very similar to lime, sp. gr. 2·3, the protoxide of *magnesium*. It is sparingly soluble in pure water, but unites freely with most acids. Its equivalent is 20 (or magnesium 12, oxygen 8), symbol Mg. O. Calcined magnesia is the true oxide, common magnesia being the carbonate, or mild magnesia. Caustic or calcined magnesia is much more injurious to plants than lime, from its retaining the caustic quality longer, and not uniting with carbonic acid so readily. It also forms a harder mortar with water, and is more apt to cake about the stems and roots of herbage; but mild magnesia (the carbonate) is of service to vegetation, being found in the ashes of most plants, in all probability replacing lime. The carbonate of magnesia is slightly soluble, and, like mild lime, is freely dissolved by water, containing carbonic acid in solution.

The sulphate of magnesia, Epsom salt, is the most important salt. Silicates of magnesia are abundant in nature, forming serpentine, soapstone, &c.

MAGNESIAN LIMESTONE. Limestone rocks containing magnesia; they abound above the coal formation. As the magnesia is to be regarded as injurious when lime is wanted for farming, its amount may be discovered by the following means: Take 100 grains of the rock, add four times its weight of strong muriatic acid, filter the clear solution, and add clear limewater; it will precipitate all the magnesia as a white powder, which may be collected, dried, and weighed.

MAGNESIUM. The metallic basis of magnesia; it is bright and white like silver: symbol Mg.; eq. 12 69.

MAGNETIC NEEDLE. A small bar or needle of steel, fully magnetized, and suspended or supported so as to move freely over a card divided into the points of the compass. It is much used by surveyors to take down the bearing of the fences and other lines of a farm.

MAGNETISM. The electric fluid manifesting itself on a metallic body: iron, cobalt, and nickel are the only magnetic metals.

MAGNOLIA. A genus of handsome flowering trees. There are about 15 native species, of which *M. grandifolia*, rising 90 feet, is the noblest. The *M. macrophylla*, though a small tree, produces magnificent flowers and leaves. The *M. glauca* is a favourite in Northern shrubberies.

MAHALEB. A species of plum or cherry, used as a grafting stock: the fruit affords a violet dye.

MAIDEN HAIR. Ferns of the genus *Adiantum*, a beautiful race: the sirup of capillaire is supposed to be made from a species.

MAIZE. Indian corn. See *Corn*.

MALACODERMS (from μαλακος, *soft*, and δερμα, *skin*). A tribe of soft-skinned, serricorn beetles.

MALARIA. The poisonous exhalations of stagnant marshes and low new lands, producing bilious fever, agues, and plagues. It is most active at nightfall and during night, and may be partially avoided by remaining at home at these times, and taking care to keep the premises warm and dry: the spring and autumn are the worst seasons. Strangers are more liable to the influence of malaria than natives.

MALE FLOWERS. Such as have stamens only, and no ovary or swelling under the petals.

MALIC ACID. The sour principle of apples, oranges, and numerous fruits; when pure, it is intensely sour and crystalline; combines with oxides to form mallates: formula $C_8 H_4 O_3 + 2 HO$: it is bibasic. By heating the hydrated acid, it is converted into maleic acid and fumaric acid.

MALIGNANT. Rapidly fatal, poisonous.

MALLEABILITY. The property of being extended by hammering, as in the case of gold, copper, silver, platina, iron, &c.

MALLENDERS. A disease produced in horses by neglect and over work, in which chaps or cracks appear on the inside of the fore legs, near the knees, attended by a discharge of a red ichorous fluid; the sores should be washed with soap and water, and kept clean; afterward they are to be dressed with an ointment containing blue vitriol: the animal is also to be kept quiet and purged.

MALLOW. The genus *Malva*; plants usually with perennial roots, and abounding in mucilage: they are eaten by all animals.

MALT. Barley which has been prepared or malted, by which sprouting is induced, and the grain becomes much sweeter.

MALTING. The process consists of three steps: 1st, *steeping*. The good barley is thrown into large wooden cisterns, and covered with water a few inches, being left for 48 to 60 hours, or until the grains are soft, but do not yield milk on pressure. 2d, *couching*. The steeped grain is removed to a floor of stone, and piled in heaps 12 to 16 inches high; here it first dries, and then heats: roots begin to appear as the heat advances; the couch is spread and made thinner: the time required is from 16 to 20 days, at a temperature of 60° Fahrenheit. In dry weather, the couch is watered when too dry. 3d, *kiln-drying*. As soon as the barley is sufficiently germinated and become dry, it is carried to the kiln to destroy the vegetative power and secure the sugar formed. It is here laid three or four inches deep, and kept at 100° Fahrenheit, till all the moisture is driven off, the malt being repeatedly turned. When nearly dry, the heat is raised to 160° Fahrenheit, until the grains become coloured to suit the beer or market; the fire is then allowed to die out. The process requires nearly two days. The malt should be kept in a dry loft until wanted: 100 pounds of good barley will yield 80 of malt. The kiln, in small operations, need be no more than a room with a draught through it, heated by the pipe of a stove. In drying, the small roots break off, and furnish the malt dust.

MALT DUST. It is sometimes called malt combs, and has been found useful as a manure or a top-dressing when sown over the cereal grasses in the early spring season.

The proper quantity of dust is, if top-dressed, for wheat, 36 to 40 bushels; if drilled with the crop, for barley and turnips, 30 to 34 bushels. It is also eminently calculated for grass lands, and if applied in the latter proportion, it will produce a very considerable increase of the best feed. Malt dust is also in some places employed in the feeding of milch cows and pigs.

MALUS. The generic name of the apple.

MALVACEÆ (from *Malva*, one of the genera). "A natural order of mucilaginous, exogenous plants, with polypetalous flowers and monadelphous stamens. The species are herbs, bushes, or trees, and are found all over the temperate and tropical parts of the world, especially the latter. Their flowers are in many cases large and handsome; but the order is chiefly interesting from the *Gossypium*, or true cotton plant, forming a part of it. Another species is the marshmallow, or *Althæa officinalis*; and some yield a fibre fit for manufacture into cordage."—(*Lindley*.)

MAMMALIA (from *mamma, a teat*). The highest division of animals, with developed extremities, a vertebral column, and mammæ.

MAMMARY. Relating to the breast.

MAMMILLARY. In minerals, covered with rounded knobs like small teats

MANDIBLE, MANDIBULA (from *mandibula, a jaw*). In zoology, this term is applied to the lower jaw of mammals, and to both jaws of birds (except by Illiger, who restricts its appellation to the lower jaw in this class also). In insects, it is applied to the upper or anterior pair of jaws.

MANDIBULATES, MANDIBULATA. The name of a grand section of insects, including all those which preserve their organs of mastication in their last or perfect state.

MANDISC. The cassava plant (*Janipha manihot*).

MANDRAKE. A fabulous root.

MANDREL. A revolving shank to which turners affix their work in the lathe.

MANEGE. The management of horses.

MANGANESE. A black mineral, the peroxide of manganese. The metal is gray, brittle, and hard; sp. gr., 8: not used in the arts. The black oxide is used to obtain oxygen; it consists of Mg. 28 + oxygen 16. The protoxide of manganese forms numerous salts, some of which are occasionally present in the ashes of plants, probably as a substitute for iron; they do not appear to be important. There is also a *manganic* and *per manganic* acid, which are, however, without agricultural interest.

MANGE. "A skin disease, which attacks several domestic animals, especially the dog, and which is attended with an eruption and loss of hair.

"In the horse it is known to exist by the animal's constantly rubbing or biting himself, so as to remove the hair, and sometimes produce ulceration. The hair of the mane and tail frequently falls off, and small scabs may generally be observed about the roots of those which remain. This disease is seldom met with, except in common stables, where scarcely any attention is paid to the horses, and where their food is of the worst quality: horses highly kept, if not properly attended to, are also subject to this disease, which is very contagious.

"The causes of mange are sudden charges of temperature, hot stables, bad diet, joined to want of cleanliness. The perspirable matter being never properly removed by friction, and being frequently mixed with dust, &c., completely plugs up the external exhalants, whereby they become obstructed, and a diseased action takes place. It may also be caused by infectious matter coming in contact with the skin; as when a sound horse rubs himself against the stall in which a mangy horse has been kept. The principal symptoms are the horse growing very thin without any apparent cause, attended with a staring of his coat; this is soon followed by eruptions, which discharge a thick yellowish matter, forming a kind of scurf, which peels off, and is succeeded by fresh eruptions, and the hair falls off. This, though partial at first, soon spreads all over the body, is attended with an itching, and causes the horse to rub against everything he comes near. In this disease, great attention to cleanliness is necessary.

"In the horse, the following will be found the best remedy. Bleed to the extent of two or three quarts, according to the constitution of the animal, and after first preparing the horse by bran mashes, give the following dose of physic:

Barbadoes aloes	6 drachms
Powdered ginger	2 "
Castile soap	2 "
Oil of caraways	20 drops.

Honey or molasses, sufficient to form a ball. After which, give the following alterative balls: 2 oz. each of powdered black antimony, powdered nitre, flour of sulphur, Castile soap, and anise seed powder, 1 oz. of rosin, added to a sufficient quantity of honey to make eight balls, one to be given every night.

"The following ointment may be applied externally:

Black sulphur	8 ozs.
Strong mercurial ointment	2 "
Soft soap	4 "
Train oil	1 pint.

"These ingredients to be well mixed, and one third part carefully rubbed in daily. If the above ointment should be found ineffectual, four ounces of spirit of tar may be added.

"Dogs and swine are frequently subject to mange. For the common scabby variety in the dog, the following ointment is recommended:

Powdered sulphur	4 ozs.
Muriate of ammonia, powdered	½ "
Venice turpentine	½ "
Lard, or other fatty matter	6 "

Well mixed.

MANGEL WURZEL, MANGOLD WURZEL. See *Beet*.

MANGER. The trough or crib from which animals eat.

MANGO. "It is a very large fruit-tree, inhabiting the tropical parts of Asia, throughout all which it is as extensively cultivated as the apple and pear trees are in Europe. Old specimens have been seen with a trunk from 10 to 15 feet in circumference. The fruit is something like a nectarine, but more compressed, longer, and more curved. It contains a large stone, covered with coarse fibres, which lose themselves in the succulent flesh. The wild and inferior varieties of this fruit taste so strongly of turpentine as to be wholly unfit for use by Europeans; but in the fine varieties this flavour is replaced by a rich sugary quality, which renders it very delicious. The fruit of the *Mangifera Indica*, a tree cultivated in Asia, is also called *mango*."—(*Brande.*)

MANGOSTEEN. The fruit of the *Garcinia mangostana*, growing in Java and the Molucca Islands; it is of the size of an orange, and of a delicious flavour.

MANGROVE. Small trees of the genus *Rhizophora*, inhabiting the rivers and coasts of the tropical world.

MANHADDEN. *Clupea manhaden.* A migratory fish, resembling the herring, taken in immense quantities off the eastern and northern coasts for manure; they should be made into a compost with earth or peat: some apply them naked to the land.

MANIOC. Cassava, tapioca.

MANIPULATION. The operations of the laboratory.

MANITRUNK, MANITRUNCUS.

The anterior segment of the trunk of insects, on which the head is placed.

MANNA. A sweet, gummy exudation of the ash (*F. ornus*) and other trees, used in medicine as a laxative. Manna, dissolved in hot alcohol, and allowed to cool, deposites a white powder (*mannite*); this, although sweet, is incapable of vinous fermentation.

MANTEL. In building, the wood, stone, &c., lying from one jamb to the other of the chimney.

MANTIS. A genus of orthopterous insects, with an exposed head, long and narrow body, and wings plaited longitudinally: they are vegetable eaters.

MANURES. Substances intended to increase the fertility of the earth. They are usually divided into mineral or fossil, animal, and vegetable manures, as they are derived from these kingdoms; but in this way we gain no knowledge of their action on the soil or plants. A better division is into *Amendments*, or such manures as improve the texture of soils, as lime, marl, peat; *Manures* supplying elements deficient in the soil, as gypsum, bone earth, ashes; and, thirdly, manures intended to advance or stimulate vegetation, as putrescent animal matters. But the greater number of manures are natural composts that supply everything necessary to the development of plants, in a more or less concentrated form, as stable manure, straw of different kinds, guano, night-soil, &c. The manures are treated under their separate heads.

In the application of manures intended to remedy a defect in the soil, as gypsum where sulphuric acid is absent; bone earth where phosphoric acid is wanting, it may be economical, by an analysis of the soil, to be certain that such a deficiency exists, otherwise our manures might be better applied elsewhere. But most of our soils require good tillage, amendments, and then natural composts to increase the crop; hence the values of manures in the experience of the farmer does not exactly coincide with the theoretical value, and the amount of nitrogen or stimulating element they contain is in practice the best criterion of their effects, the soil being in good order and tilth. Hence Boussingault and Payen, practical men, have constructed a table of the value of all manures, as compared with farm-yard manure, on this basis. The first column gives the kind of manure in its ordinary state, the second the amount of water it contains, the third and fourth the per centage of nitrogen in the dry and wet states, the fifth and sixth the quality of the manure in the dry and wet states, so far as the effects of the ammonia or nitrogen are concerned, the seventh and eighth columns represent the amount of the manures, respectively, equivalent to 100 lbs. of farm-yard manure, both in the dry and wet states, so far as the nitrogen is concerned. Thus we learn that 8 lbs. of linseed oil-cake are equally serviceable with 100 lbs. of farm-yard manure in the ordinary state of moisture, &c. (For table, see the following pages.)

The greatest improvements in manures recently made are their economy for different plants, or the system of special manures referred to under the principal crops in this work, and their application with the seed or on growing plants, by drills and other contrivances. The old method of scattering immense amounts over the soil a long time before the crop is justly considered unprofitable.

The following table of the weight of a cubic yard of several manures is of some practical value:

	cwts.	qrs.	lbs.
Garden mould	19	3	25
New dung	9	3	18
Leaves and sea-weed	9	0	3
Water	15	0	3
Compost of dung, with weeds and lime	14	0	5

—See *Farm-yard Manure*.

MANURES, ARTIFICIAL AND SPECIAL. These are compounds prepared for sale to farmers, as artificial guano, poudrette, silicate of soda, sulphate of soda, sulphate of ammonia, soda ash, solution of bones, saltpetre, and urate. Special manures are those which are designed to advance particular crops.

TABLE OF THE COMPARATIVE VALUE OF MANURES, DEDUCED FROM ANALYSES MADE BY MESSRS. PAYEN AND BOUSSINGAULT.

Kinds of Manure.	Water per 100.	Nitrogen in 100 of matter.		Quality according to state.		Equivalent according to state.		Remarks.
		Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	
Farm-yard dung	79·3	1·95	0·41	100	100	100	100	Average of Bechelbronn.
Dung water	99·6	1·54	0·06	78	2	127	68	Washed by the rain.
Wheat straw	19·3	0·30	0·24	15	60	650	167	Fresh, of Alsace, 1838.
Rye straw	12·2	0·20	0·17	10	42·5	975	235	Of Alsace.
Idem	12·6	0·50	0·42	26	105	390	95	Environs of Paris, 1841.
Oat straw	21·0	0·36	0·28	18	70	542	143	
Barley straw	11·0	0·26	0·23	13	57·5	750	174	
Wheat chaff	7·6	0·94	0·85	48	212·5	207	47	Of Alsace.
Pea straw	8·5	1·95	1·79	100	447·5	100	22	
Millet straw	19·0	0·96	0·78	49	195	203	51	
Buckwheat straw	11·6	0·54	0·48	27	120	361	83	
Lentil straw	9·2	1·12	1·01	57	250	174	40	
Dried potato tops	12·9	0·43	0·37	22	92·5	453	108	
Withered madia stalks	14·3	0·66	0·57	33	142·5	295	70	After seeding.
Idem turned under while green	70·6	1·53	0·45	79	113	126	89	Before seeding.
Dried broom	10·4	1·37	1·22	70	305	142	33	Stalk and leaves.
Withered leaves of beet root	88·9	4·50	0·50	230	125	43	80	Of mangel wurzel.
Do. of potatoes	76·0	2·30	0·55	117	137·5	85	73	Withered top and leaves.
Do. of carrots	70·9	2·94	0·85	150	212·5	66	47	
Leaves of heather	7·0	1·90	1·74	97	425	103	23	Dried in the air.
Do. of pear-trees	14·5	1·59	1·36	81·5	340	127	29	
Do. of oak	25·0	1·57	1·18	80	293	125	34	
Do. of poplar	51·1	1·17	0·54	66	134	167	74	Leaves fallen in autumn.
Do. of beech	39·3	1·91	1·18	78	294	102	34	
Do. of acacia	53·6	1·56	0·72	80	180	125	56	
Box-tree	59·3	2·89	1·17	147	293	68	34	Branches and leaves.
Clover roots	9·7	1·77	1·61	90	402·5	110	25	Dried in the air.
Fucus digitatus	39·2	1·41	0·86	72	215	139	46	
Idem	40·0	1·58	0·95	81	237·5	123	42	Dried in the air.
Fucus saccharinus	40·0	2·29	1·38	117	345	85	29	
Idem	75·5	——	0·54	——	135	——	74	Fresh.
Burned sea weed	3·8	0·40	0·38	20	95	488	105	
Oyster shells	17·9	0·40	0·32	20	80	488	125	
Sea shells	——	0·05	0·05	3	13	3750	769	Dried sea shells of Dunkirk.
Mud of the Morlaix River	3·7	0·42	0·40	21	100	464	100	Sea sand.
Trez of Roscoff roads	0·5	0·14	0·13	7	32·5	1393	308	
Sea-side Marl	1·0	0·52	0·51	26·5	128	377	78	
Salt cod fish	38·0	10·86	6·70	557	1675	18	6	
Cod-fish washed and pressed	10·0	18·74	16·86	961	4215	10	2½	Dried in the air.
Fir sawdust	24·0	0·22	0·16	11	40	886	250	
Idem	24·0	0·31	0·28	15	57·5	629	174	Dried in the air.
Oak sawdust	26·0	0·72	0·54	36	135	256	74	
White lupine seed	10·5	4·35	3·49	223	872·5	45	111½	Tuscan, boiled and dried.
Malt grains	6·0	4·90	4·51	251	1127·5	40	9	
Grape husks	48·2	3·31	1·71	169	427·5	57	23	
Oil cake of linseed	13·4	6·00	5·20	307	1300	33	8	
Do. of colewort	10·5	5·50	4·92	282	1230	35	8	
Do. of arachis	6·6	8·89	8·33	655	2082·5	21	4½	
Do. of madia	11·1	5·70	5·06	292	1265	34	8	
Do. of sesame	6·5	5·93	5·52	304	1378	33	7¼	
Do. of hemp seed	5·0	4·78	4·21	245	1052	41	9½	
Do. of poppy	6·0	5·70	5·36	292	1340	34	7½	
Do. of beech mast	6·2	3·53	3·31	181	828	55	12	
Do. of walnuts	6·0	5·59	5·24	287	1310	35	7½	
Do. of cotton seed	11·0	4·52	4·02	231	1000	32	10	
Cider-apple refuse	6·4	0·63	0·59	32	147	309	68	Dried in the air.
Refuse of hops	73·0	2·23	0·56	114	140	88	67	
Beet-root refuse	9·3	1·26	1·14	64	285	155	35	Dried in the air.
Idem	70·0	——	0·38	64	85	——	106	Fresh from the press.
Squeezed beet root	94·5	1·76	0·01	90	2	111	4137	Process of Dombasle.
Potato refuse	73·0	1·95	0·53	100	131·5	100	76	
Potato juice	95·4	8·28	0·38	425	94	23	106	Settled and decanted.
Water of the starch manufactory	99·2	8·28	0·07	425	17·5	——	571	From washing in four volumes of water.
Deposite from the water of do.	80	1·81	0·36	92	90	108	111	Drainings from heap.
Idem	15	1·81	1·54	92	384·5	——	24	Dried in the air.
Solid cow dung	85·9	2·30	0·32	117	80	84	125	
Urine of cows	88·3	3·80	0·44	194	110	51	91	
Mixed cow dung	84·3	2·59	0·41	132	102·5	75	98	
Solid horse dung	75·3	2·21	0·55	113	137·5	88	73	
Horse urine	79·1	12·50	2·61	641	652·5	15½	15⅓	The horse drank but little; the urine was thick.
Mixed horse dung	75·4	3·02	0·74	154	185	66	54	
Pig dung	81·4	3·37	0·63	172	157·5	58	63	
Sheep dung	63·0	2·99	1·11	153	277·5	65	36	
Goat dung	46·0	3·93	2·16	201	540	50	18½	
Liquid Flemish manure	——	——	0·19	——	47·5	——	210	In the normal state.
Idem	——	——	0·22	——	55	——	182	
Poudrette of Belloni	12·5	4·40	3·85	225	962	44	10⅓	Dried in the air.
Do. of Montfaucon	41·4	2·67	1·56	137	300	73	25½	
Urine of public vats	96	17·56	16·83	900	4213	11	2⅓	Dried in the stove.
Idem	96·9	23·11	0·72	1133	179	8½	56	Thin, ammoniacal.

TABLE (Continued.)

Kinds of Manure.	Water per 100.	Nitrogen in 100 of matter.		Quality according to state.		Equivalent according to state.		Remarks.
		Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	
Animalized black	44·6	1·96	1·09	100·5	272	98	37	Prepared for 11 months.
Idem from the neighbourhood of Paris	42·0	2·96	1·24	151·6	310·5	66	32	Recently made.
Idem, called Dutch manure	44·1	2·48	1·36	127	340	79	29½	Made at Lyons.
Animalized sea weed	12·1	2·73	2·40	140	600	7	16½	Dried in stove (from Marseilles).
Pigeon's dung	9·6	9·02	8·30	462	2075	21½	5	Of Bechelbronn.
Guano imported into England	19·6	6·20	5·00	323	1247	31½	80	In the ordinary state.
Idem	23·4	7·05	5·40	361	1349	28	74	Sifted.
Do. imported into France	11·3	15·73	13·95	807	3487	12½	28½	
Silk-worm litter	14·3	3·48	3·29	178·7	827	56	12	Fifth age.
Idem	11·4	3·71	3·29	190	822	53	12	Sixth age.
Chrysalis of silk-worm	78·5	8·90	1·95	461	485	21½	20½	
Cockchafers	77·0	13·93	3·20	714	801	14	13	
Dried muscular flesh	8·5	14·25	13·04	730	3260	13⅓	3	Dried in the air.
Soluble dried blood	21·4	15·50	12·18	795	3045	12½	3⅓	As sold.
Liquid blood	81·0	———	2·95	795	736	———	13⅓	From slaughter-houses.
Idem	82·5	———	2·71	795	580	———	15	From worn-out horses.
Blood coagulated and pressed	73·5	17·00	4·51	871	1128	11½	9	Just out of the press.
Insoluble dried blood	12·5	17·00	14·88	871	3719	11½	2¾	Dried in manufactory.
Dregs from Prussian blue manufactory	53·4	2·80	1·31	144	526	7	30½	Animalized with blood.
Melter's bones	7·5	7·58	7·02	388	1754	26	6	Dried in the air.
Fresh bones	30·0	———	5·31	———	1326	———	7½	As sold by the melters.
Fat bones, not heated	8·0	———	6·22	———	1554	———	6½	Including 0·10 of fat.
Dregs of bone blue	42·0	0·91	0·53	47	133	214	76	
Glue dregs	33·6	5·63	3·73	288·4	933·5	35	11	As sold by the makers.
Graves	8·2	12·93	11·88	663	20695·3	15	3⅓	
Animal black of the sugar refiners	47·7	2·04	1·06	104	265	96	38	As sent out.
Sugar refiner's black	27·7	19·01	13·75	974	3437	103	28	From Paris.
Scum from the sugar refinery	67·0	1·58	0·54	81	134	127	75	From the sugar bakery of Vigneux.
English black	13·5	8·02	6·95	411·4	1738	24	6	Blood, lime, soot.
Feathers	12·9	17·61	15·34	903	3835	11	2½	
Cow hair flock	8·9	15·12	13·78	775	3445	13	3	
Woollen rags	11·3	20·26	17·98	1039	4495	9½	2¼	
Horn shavings	9·0	15·78	14·36	809	3590	12⅓	3	
Coal soot	15·6	1·59	1·35	81	337·5	122	30	
Wood soot	5·6	1·31	1·15	67	287·5	149	35	
Picardy ashes	9·2	0·71	0·65	36	162·5	275	62	
Vegetable mould from humus dung (terreau)	———	1·03	———	53	———	189	33	Dried in the stove.

MAPLE. Trees of the genus *Acer*, of which seven are indigenous to America; they are for the most part natives of the North and Canada, where extensive forests of the sugar maple exist. The wood, though often beautifully ornamental, curled and spotted (bird's-eye maple) from the sugar-maple trees, is soft, and incapable of enduring exposure; it is therefore confined to cabinet uses, and forms excellent fuel, yielding an ash from which four fifths of the potash of commerce is derived. The maples require a deep, light soil, and become fully developed on rich alluvial plains.

The white maple (*A. eriocarpum*) is a Western tree, very early, and yields a saccharine juice, from which sugar is made in Ohio. The red (*A. rubrum*) is also sweet, and yields a handsome wood: it flourishes on rich bottoms. The striped or moose wood (*A. striatum*) is confined to the most Northern localities, and furnishes excellent browse for cattle. The mountain maple (*A. montanum*) is a small Northern dwarf, of six or eight feet.

The sugar maple (*A. saccharinum*) abounds from 43° to 46° North latitude: it often rises to 70 or 80 feet, with a beautiful white bark. The wood is highly ornamental. The trees are tapped with a three-quarter-inch auger early in March, at eighteen to twenty inches from the ground; two holes are made in each tree, not deeper than two inches within the wood. Tubes of wood are inserted into the holes, which convey the sap to troughs or buckets on the ground. The sap is collected each day, and kept in casks until it can be boiled down. All the arrangements for finishing the work are taken to the sugar camp, so that the boiling advances nearly as fast as the juice is obtained. The boilers are of iron, of fifteen to twenty gallons, and only half filled. The process of boiling is rapid; and if much scum rises, a little butter or lard is used to hinder it from flowing over: the sirup is sufficiently strong when a small portion granulates on cooling. The sirup is poured into granulating moulds, and the molasses drawn off.

Great care is necessary as the sirup approaches the crystallizing point, to prevent burning it; as in such a case, instead of sugar, only a black, wax-like mass will be produced, bitter to the taste, and unfit for culinary purposes. The excellence of maple sugar is in a great degree depending on the cleansing of the sirup. To do this effectually, the sirup, after being brought to the proper consistence, should be strained and allowed to become cool, when it will be of the thickness of good molasses. Into this some albuminous substance (the whites of eggs are the best, though, where eggs are not to be had, milk will do very well) must be thoroughly incorporated by stirring, while it is cool, and then, when placed on the fire, suffered to remain entirely at rest until on the point of boiling. The albumen diffused through the mass coagulates by the heat, and rising to the surface, brings up with it all the impurities contained in the sirup. If this operation of cleansing is performed skilfully, the sirup remaining in the kettle will be pure liquid, free from specks, and when crystallized will make a beautiful sugar. The skimming of the sirup should be carefully kept from all animals, for, though nearly all are exceedingly fond of it, it is injurious to all, and fatal to many. Maple sugar is hard, of a light brown, with an aromatic taste; it yields the purest refined sugar, and is as good as any variety for domestic purposes.

The sap flows of good quality for six weeks, and afterward the juice is only fit for molasses. A tree sometimes yields two gallons daily of sap, containing a quarter of a pound of crystallizable sugar to the gallon. The sap rapidly ferments in warm weather, running into vinegar in three or four days. This may be partially averted by adding a little lime-water to the juice. Three persons can manage 250 trees, and may expect 1000 lbs. of sugar, or four pounds from each. The sugar yielded from trees previously tapped increases.

In the Western States, sugar is made from the black maple (*A. nigrum*), the leaves of which are darker than the Northern sugar maple. The white maple, from the quickness of its growth, has been recommended for sugar plantations as far south as North Carolina.

MARASMUS. Leanness, wasting away.

MARBLE. Limestones with a granular and crystalline appearance; they are for the most part primary or transition. The colours and variegations are adventitious, depending upon the presence of other minerals. Good marble being entirely carbonate of lime, yields 56 per cent. of lime when well burned.

MARC. The refuse remaining in the press after expression of fruits.

MARCESCENT. Withering on the stem, like the leaves of endogens.

MARCH. The third month, in which the soil is yet frozen, but garden operations in frames should be pushed forward, manures collected and carried out, and everything got in readiness for the start of vegetation. In the South, early grains are sowed, and the soil is prepared for the staple crops.

MARE. Female of the horse.

MARE'S TAIL. *Hippuris vulgaris.* A useless weed, growing in wet, sandy places.

MARGARIC ACID. The acid of margarine, obtained by saponifying. It is pearly, insoluble in water, but readily in hot alcohol; fuses at 140°, reddens litmus, and resembles stearin. It exists in human fat and numerous oils: formula, $C_{68}\ H_{66}\ O_6 + 2\ H\ O$.

MARGARINE. The solid, white fat of olive and other oils. A margarate of glycyrine.

MARGARITIC ACID. One of the fat oils peculiar to castor oil.

MARGARONE. A product of the distillation of margaric and stearic acids; a white, pearly mass: formula, $C_{33} H_{33} O$.

MARGARYL. A compound radical: formula, $C_{34} H_{33} O_3$.

MARIGOLD. *Calendula officinalis.* A composite plant, with bright yellow flowers, partially used in soups. It is an annual, readily propagated by seeds.

MARINE ACID. Muriatic acid, hydrochloric acid.

MARINE SALT. Common salt, chloride of sodium, muriate of soda.

MARIOTTE'S LAW, BOYLE'S LAW. The law which expresses the constant relation between the bulk and pressure of a permanent gas, the elasticity or pressure being directly proportional to the density, and inversely to the bulk.

MARJORAM. *Origanum.* "A genus of well-known, pungent, and gratefully aromatic herbs. The plants are all of easy cultivation; the shrubby kinds are increased by cuttings or slips; the herbaceous species by dividing at the roots. There are as many as eight species, besides numerous varieties. The species generally cultivated are the common or pot marjoram (*O. vulgare*), and sweet or summer marjoram (*O. majorana*), and bastard or winter marjoram (*O. heracleoticum*).

"A light, dry, and moderately fertile soil is required for their healthy growth; and if it is one that has not been cropped for a considerable time, it is the more favourable for them. If the soil is wet or rich, they are deficient in their essential qualities, and the perennials are unable to withstand severe weather. The situation cannot be too open. The sweet marjoram is propagated solely by seeds; the two perennials by seed, as well as by parting their roots, offsets, and slips of their branches. Sowing may be performed of all the species, from the conclusion of February, if open weather, to the commencement of June; but the early part of April is the usual time for performing it. Portions of the rooted plants, slips, &c., may be planted from February until May, and during September and October.

"The sowing is performed either in drills, six inches apart, or broadcast, in either case the seed being buried not more than half an inch deep.

"The tops and leaves of all the species are gathered when green, in summer and autumn, for use in soups, &c.; and a store of the branches is cut and dried in July or August, just before the flowers open, for winter's supply."—(*Johnson.*)

MARK. The black dot on the corner teeth of the horse when five and a half years old. It is gone, or *rased*, when he is eight years.

MARKETS, AGRICULTURAL. "The more numerous markets are in any well-cultivated country, provided they are at a sufficient distance not to interfere with each other, and on different days of the week, the greater saving there is of time and labour of conveyance. Good roads or navigable rivers are of great importance to a market-town; and if there are mills in the neighbourhood where corn can be ground, they will increase the advantage to the farmer by causing a regular demand above what the immediate consumption of the place may require.

"The vicinity of a good market, where every kind of agricultural produce will always find purchasers at a fair price, greatly adds to the value of a farm, especially if good roads lead to it; and the advantage is the greater if it be a populous town, which not only consumes much produce, but from which various kinds of manure may be brought by the teams which have carried the produce to market. It is this which so much enhances the rent of land near London and all great cities, and makes the agriculture there approach nearer to horticulture, which entirely depends on extraneous manure"

MARKING INK. See *Indelible Ink.*

MARKING NUT. The seed of the *Semicarpus anacardium*, a tropical tree, the juice of which stains linen of an indelible black.

MARL. A mixture of earths containing a large amount of mild lime. It is clayey or argillaceous when it has the mechanical characters and touch of clay, sandy when silicious, and calcareous when almost entirely composed of mild lime: it is also shelly when full of fossil shells. There is one feature common to all true marls, viz., effervescence with acids. Marl may be derived from ancient formations, more especially the upper red sandstone, but is for the most part of tertiary origin, or modern, being produced in ponds and rivers flowing in limestone countries. The richest shell kinds are best, as they contain bone earth. The value of marls is precisely as the amount of lime they contain. When very rich, they may be burned for quicklime, which much increases their activity and value. Marls seldom contain more than twenty per cent. of carbonate of lime associated with sands or clay. They are applied at the rate of fifteen to thirty wagon loads the acre, and do much good by altering the texture of some soils, as when a clay marl is applied to sandy lands. In some cases one hundred wagon loads have been applied. They are chiefly indicated where the soil lacks lime, or may be improved mechanically; but being, for the most part, mineral composts, marls are usually serviceable, and often extremely beneficial, especially to poor, sandy lands. Shell and coral sands are of the nature of silicious marls, but more active, from containing organic matter.

The following analysis, by Sprengel, gives the composition of several kinds of marl:

	Composition of Marls from					
	Luneburg.	Osnabruck.	Magdeburg.	Brunswick.	Weser-marsh.	Brunswick.
	Powdery.	Stony.	Clayey.	Loamy.	Powdery.	Stony.
Quartz-sand and silica	5·6	23 0	58·4	73·4	78·9	71 1
Alumina	0·4	10·0	8·4	1·9	3·1	4·0
Oxides of iron	4·2	1·9	6·7	3·2	3·8	6·5
Do. of magnesia	trace	trace	0 3	0·3	0·3	1·1
Carbonate of lime	85·5	35·0	18·2	18·1	8·2	13·3
Do. of magnesia	1·25	0·9	3·8	1·5	3·0	2·6
Sulphuret of iron	—	7·3	—	—	—	—
Potash and soda, combined with silica	0 05	trace	1·6	0·8	0·9	0·2
Common salt	0·03	trace	trace	trace	0·1	trace
Gypsum	0·06	0·9	2·1	0·1	0·5	trace
Phosphate of lime (bone earth)	2·3	0·5	0·5	0·7	1·2	1·2
Nitrate of lime	0·01	—	—	—	—	—
Organic matter	0·6	carbon 20·05	—	—	—	—
	100	100	100	100	100	100

The marls are usually applied on a fall fallow, on the surface, and left to crumble during the winter and spring; they are also applied as top-dressings to meadows.

The quality of any marl is ascertained by weighing 300 grains of strong muriatic acid into a flask, and then 100 grains of the marl, adding it to the acid carefully in powder; and weighing again after all effervescence has subsided, the loss in the 400 grains will be carbonic acid, and is about equivalent to the amount of lime in the specimen, in the ratio of 22 gas to 28 lime. Marling is particularly serviceable for clovers, pease, beans, hemp, and potatoes.

MARMALADE. A sweatmeat of the pulp of fruit, usually of the peel of oranges.

MARMORATUM. In building, a cement of pounded marble with lime.

MARRAM. The sea reed (*Arundo arenaria*).

MARROW. The oily fat filling the cavities of the long bones.

MARSH. A low, partially flooded tract of land overgrown with coarse grasses and sedges. The herbage of salt marshes is often very good fodder, and regularly cut for cattle. They are frequently made available by embankments and drainage, and constitute fertile, wet meadows.

MARSH MALLOW. *Althæa officinalis.* An herbaceous perennial, of the family *Malvaceæ*, preferring moist lands, and very readily cultivated by seeds, slips, &c. It is very mucilaginous, and is used in coughs as a sirup.

MARSH MARIGOLD. *Caltha.* Ornamental water plants.

MARSH MIASM. The pestilential emanations from marshes, producing agues and intermittent fevers.

MARSH MUD. The scrapings of rivers, bogs, and marshes often yield a fertile mud, which may contain much decaying vegetable matter, marl, or other fertilizing bodies. It is, therefore, occasionally added to lands with great advantage, especially where there is much difference in the texture of the land and mud. That which is black and fœtid will usually be best: admixture with lime will greatly improve it. As much as twenty per cent. of vegetable matter has been found in some specimens, but as the composition is very different, it is best for the farmer, while he recognises the utility of marsh mud, to make small trials with it first, before going to much expense in carting a quantity out. It may be applied in the natural state, after being exposed one winter to frost, or composted with lime, animal matter, &c. Thirty or more loads are applied per acre, and where a different texture is to be given to the land, several hundred may be used. The point to be considered is the economy of using such coarse amendments.

MARSUPIALS. Quadrupeds with an abdominal pouch, in which their young reside, as the opossum, kangaroo.

MARTINGAL. A part of the bridle fastened by a thong to the girth, and furnished with two straps carrying rings, through which the reins pass. It hinders the horse from tossing his head.

MARUM. Bitter, strong-scented.

MASCAGNIN. Native sulphate of ammonia, found in volcanic districts.

MASH. A mixture in hot water. A soft sort of diet occasionally given to horses. It is prepared by pouring boiling water upon a small quantity of ground malt, bran, or other similar substance, in a pail, so as just to wet it well. After this has been done, it should be well stirred about, till it is thoroughly mixed and sweetish to the taste, when, after becoming lukewarm, it is in a proper state to be given to the animal. It is frequently used after purges to increase their operation, as well as after hard labour, and in the time of disease. Mashes are very useful for restoring animals in these circumstances.

MASONRY. The art of building, especially with stones.

MASSETER. The muscle which moves the lower jaw.

MASSICOT. Yellow oxide of lead.

MAST. The nuts of beach, oak, chestnut, &c., forming admirable food for hogs, and often worthy of collection for winter store.

MASTIC. The resin of the *Pistacia lentiscus*, extensively used in making varnishes. Also a cement used in plastering walls.

MASTICATION. Chewing. The reduction of grains, &c., into meal by the teeth. Old animals require this to be done artificially for them. It is very essential to health that it be properly performed.

MASTIFF. The large guard dog. He has small, drooping ears, smooth skin; is variously coloured, hanging lips, large jaws, and is strong, and very large.

MASTOID. Small knobs or elevations on bones, &c.

MATE. The Paraguay tea.

MATERIA MEDICA. The collection of drugs used in medicine, farriery, &c.

MAT GRASS. *Nardus stricta.* An insignificant Southern grass, growing on barren lands.

MATRASS. A chemical flask, with a long neck, used for heating or boiling fluids.

MATRIX. A womb. A place where anything is formed. The mineral in which metallic ores or choice crystals are imbedded.

MATTER. Anything that has weight or sensible properties, as divisibility, impenetrability, extension. It is organized or inorganic, elementary or compound.

MATTOCK. The pickaxe. The iron ends may be pointed or of the figure of a chisel; the handle of oak or ash.

MATURATION. Ripening. The formation of pus in abscesses.

MAT WEED. The sea reed.

MAUL. A large mallet, or beetle, to split wood.

MAW. The stomach. *Maw skin* is the prepared stomach for rennet.

MAW SEED. The small *Poppy*, which see.

MAXILLA. The jaw. In zoology, it means the upper jaw; in entomology, the inferior pair of jaws.

MAXILLARY. Related to the jaws, as the maxillary glands, arteries.

MAY. The most important agricultural month. In the North, oats being sowed, and the land manured and in good tilth, corn planting is commenced; potatoes are also to be set out; meadows should be harrowed where wanted, and manured; hemp and most crops are sown this month; everything is to be done out of doors; in the garden, cabbages, cucumbers, melons, lettuce, &c., are transplanted from the hot-beds; pease, beans, root crops, &c., sowed; spring budding and grafting are carried on until trees are in leaf. In the South, tobacco is transplanted, the young cotton plants are cleaned, pease are sown in the corn-hills, the sugar-cane is to be worked, and sweet potato cuttings set out.

MAY-APPLE. *Podophyllum peltatum.* Wild mandrake. An herbaceous perennial, growing in moist woods, bearing one stem with two leaves; the roots are cathartic; the yellow fruit, often two and a half inches long, is acid and pleasant: it is worthy of cultivation.

MAY-TREE. The hawthorn.

MAY-WEED. *Matricaria chamomilla*, and other plants. Perennial-rooted, composite herbs, overrunning rich cultivated lands; they should be mowed before flowering, and exterminated by cultivating hoed crops.

MEAD. A wine made by fermenting one part honey boiled in three parts water, and flavoured with various aromatic herbs, according to the taste.

MEADOWS. "Properly, low grounds on the banks of rivers, which, being kept moist by their situation, and also occasionally flooded by the rise of the waters, are best adapted for the growth of grass, and are generally mown for hay.

"When meadows are private property they become much more valuable. The flooding is encouraged or prevented, according to circumstances, and, in many cases, artificial irrigation is adopted (see *Irrigation*). If they are exposed to be too often inundated, they are protected by dams and sluices.

"The herbage of low, wet meadows is generally coarser and less nutritious than that of those which lie higher; hence upland hay, as it is called, is preferred for the better sort of cattle. Good grass land, to which the floods never rise, is often called meadow land when the natural herbage is permanent, and frequently made into hay.

"Upland meadows are very valuable wherever there is a demand for good hay. A considerable degree of attention is required to make them most productive. Not being annually recruited by flooding, they would soon degenerate if some pains were not taken to keep up their natural fertility. This may be done in various ways: the most obvious is to recruit them frequently with the richest animal and vegetable manure, which, being spread over the surface at a time when showers are abundant, that is, either early in spring or immediately after midsummer, is washed down to the roots of the grass. A rapid growth is thus produced, which is soon perceived by comparing the appearance of a meadow which has been manured with that of one left in its natural state. It has been asserted by many agricultural authors that the produce of hay is greater when the meadows are mown every year, provided they be occasionally manured, than when mown and depastured alternately. But the productiveness of a meadow depends entirely on the circumstances of soil and situation. A meadow, the soil of which is naturally of a rich nature, and adapted to produce fine grasses, may be mown year after year without any perceptible change in the quality of the hay; while another of inferior quality requires to be occasionally cropped close, to check the growth of the coarser grasses, and to allow the finer to rise As to the effect of taking off the hay by mowing it, compared with that of the bite of cattle, there is little difference, except that, in pasturing, the grass is repeatedly cropped close to the ground as soon as it rises to such a height that the teeth of the cattle can sever it. It consequently spreads by the roots, and the pile becomes closer.

"The urine of the cattle greatly promotes luxuriant vegetation in rainy weather, but in hot, dry weather it does more harm than good. The dung, when dropped on the grass, is of little or no value compared with what it would be if mixed up with straw, earth, or peat, or diffused through water in a tank. It is therefore an excellent practice to employ women and children to collect the fresh dung in the pastures, and to carry it to a heap of earth, where it may be covered up, or to a tank, where it may be diluted with water.

"Of late years the practice of *soiling* has been extensively adopted; that is, all the grass is mown and carried every day in a green state to cows or horses tied up in a stable. By this means all the advantage of mowing for hay is obtained, besides an abundant supply of rich manure, which can be applied to the land in a liquid and diluted state, when its effect is powerful and certain. So much more fodder is produced from the land by the system of soiling, that arable fields are converted into artificial and temporary meadows, in which the different species of grasses are sown, in order to be cut green or made into hay; and when, from the nature of the soil, the herbage degenerates, the field is ploughed up again, greatly improved by this change of cultivation.

"When a natural meadow has been neglected, and the grass is of an inferior quality, and mixed with rank weeds and moss, it requires much care to restore it to its original fertility. In most cases, the shortest method and the best is to plough it up, clean and manure it during a course of tillage, without taking very exhausting crops from it, and then to lay it down again in a clean and enriched state, by sowing the best sort of grass seeds; or, which is preferable, by inoculating, or planting in it small tufts of grass from some rich meadow, which will soon increase, and produce a new and improved sward. But where the soil is a very stiff clay, with only a small depth of good mould over it, there is some danger in breaking the old sward, for it will take a long time and much manure to reproduce a proper covering of grass. In this case it is a preferable practice to scarify the meadow by means of instruments which do not go deep, but only tear up the surface. If this is done early in spring, when the ground is moist, and the whole surface is brought to resemble a fallow field, good grass seeds may be immediately sown. If rich manure, mixed with lime or chalk, is then spread over the land, and the whole well harrowed and rolled, the old and young grass will spring up together, and show a wonderful improvement in a very few months. It is prudent to mow this renovated meadow before the seeds of the grasses are formed, contrary to a common notion, that in a thin meadow the seed should be allowed to shed, in order to increase the number of plants. The notion is good, but it should be done by sowing seed which has been produced on other ground; for the ripening of the seed tends to exhaust the soil. If the grass be cut before the flower is faded, the roots will soon spread, and produce a new and improved sward.

"It must be observed that it is not indifferent what cattle are turned into the meadow after hay-making. Horses invariably produce coarse weeds by their dung and urine; cows may be depastured in autumn, as long as the surface is dry; but sheep are far more advantageous, and may be kept in the meadows at all times, if they are not too wet for the health of the sheep, and if there is no danger of their having the rot. As soon as the surface becomes soft by the autumnal rains, all heavy cattle should be excluded: every tread of a horse or cow at this time destroys a portion of good grass, and makes a hollow, in which the water remains, killing the finer grasses, and producing rushes and aquatic plants.

"The meadows which are to be mown should be shut up early in spring, and those which are soft and wet should have nothing larger than a sheep in them from November till after hay-making time the next year."

MEADOW FOXTAIL. *Alopecurus pratensis*. See *Grasses*.

MEADOW GRASSES. See *Grasses*.

MEADOW SAFFRON. See *Colchicum*.

MEAL. The flour of corn, oats, pease, &c. A meal of milk means the quantity obtained at a milking.

MEASLES. A skin disease of hogs. See *Hog, Diseases of*.

MEASURES. See *Weights and Measures*.

MEASURING CHAIN. A chain of 100 links, or 22 yards, used in surveying; the link is 7·92 inches.

MEAT. "1. *Selection of Cattle and Beef.*—In the selection of cattle to be sent alive to market, they should invariably possess fine symmetry and small bone, carrying the greatest weight of beef on the most valuable points, such as rumps, loins, and crops; the back well covered, the buttocks and flanks well filled up, and the whole carcass exhibiting a fulness of flesh, excepting the necks and coarser parts. They should handle hard and firm, in order to stand well the voyage, and handle and look well in the market. Firm handlers, whether heifers or oxen, always cut well up. An ox or heifer of these properties, weighing 80 stones (stone of 8 lbs.), will actually realize more money than a coarse ox or heifer weighing 100 stones. Heavy cattle, however, do not take readily in market, unless they are remarkably handsome; nor do very light cattle, under 40 stones, for two or three months in summer, unless they are really neatly shaped, and thick on the backs and best points.

"The meat intended to be sent to the carcass market should be taken from such cattle as we have described. It is not large quantities of lean and fat that are wanted there, but both well mixed. Ox and heifer beef of equal quality command the same prices. Rumps, loins, crops, and other fine parts fitted for roasting and steaks, are more in demand than the boiling pieces, and realize comparatively higher prices.

"2. *Selection of Sheep and Mutton.*—Ripe, compact sheep, of light weights, carrying a large proportion of lean on the back, loins, and shoulder, with a full, round leg, and handsome carcass, are admirably suited for market. Such, from 14 lbs. to 20 lbs. per quarter, will take readily; but they are most valuable from 16 lbs. to 18 lbs. The nearer the form and quality approach those of South Downs, the more likely are they to command the top prices; for the Downs have long been unrivalled favourites. Pure bred Leicesters are too fat, unless they are sent young, and do not exceed 20 lbs. per quarter; when above that weight, they fetch inferior prices.

"The carcasses of mutton to be sent to market should, of course, be those of sheep such as are here recommended to be sent alive. Large quantities of fat are not so desirable as a proportionable mixture of fat with the lean. In using the loins and other parts of very fat mutton for chops, much of it has to be pared away, and sold for the price of raw fat. The great point is to select ripe mutton and sheep, for the latter will stand the journey better than half fat, and will not lose half the quantity of flesh in three days as the latter. No overgrown animals, having masses of fat on one place and not on another, would, therefore, command the top price; but those having plump carcasses, well mixed with fat and lean, firmly and equally laid on, with fine symmetry and valuable points, will always command the top price, both at Smithfield and the carcass markets.

"3. *Selection of Lambs.*—Lambs are a favourite stock to send to market, and they are always sent alive. Leicester lambs are admirably adapted for the market. They are handsome, compact, thick on all the points; and although they might become too fat when grown to sheep, they cannot be too fat as lambs. Their flesh is white, and every joint of them looks well on the table. The lambs of the cross between the Leicester and the Cheviot and black-faced ewes are next best for fat and lean, and cut well into joints, although they have not the handsome figures of the pure Leicester. No lambs should be sent to market until they are at least three months old, and have attained the weight of 9 lbs. or 10 lbs. a quarter; and if they are not fat enough, and have not attained that weight at that age, they should be kept on. Ewe lambs are preferred, being more delicate than wethers, which are next in value. All wether lambs, therefore, should be castrated when a few days old, and their tails cut short, leaving not more than three inches. The docking gives them a very compact form, and it causes the flesh to grow up towards the back, long tails giving a contrary tendency.

"4. *Selection of Pigs and Pork.*—A very mistaken notion prevails that pigs must be fat to suit the market. The fact is quite the reverse, for the larger the pig is fattened the less money per pound it fetches. Pigs are worth the most money when their weight ranges from 35 lbs. to 40 lbs.; and from this weight up to 60 lbs. or 70 lbs. they are termed *dairy-fed porkers.* If, at the former weight, they are of good symmetry, fine quality, delicate and white in the flesh, and not more than 1 inch or 1¼ inch thick of fat on the back, they will fetch the top price of the day. Indeed, we need not be surprised at this preference, when we consider that only the small lean and fat porkers are used for roasting, chops, and pickled pork, and the large, fat pigs are chopped down for sausages. No pigs, therefore, should be sent to market exceeding 100 lbs., exclusive of head and feet, but which are only moderately fat and of fine quality; all other qualities should be cured as bacon and hams. Occasionally they arrive in pretty good order in carcass; but in carcass, in thick weather, the flesh becomes very soft, and the skin dry; and in dry weather the skin becomes quite hard and brown coloured. Of equal qualities, the live pig will draw from a halfpenny to a penny a pound more than in carcass. Feeders of pigs should be careful on what they feed their pigs, especially fish. The retail butchers are such nice judges of pork that, on buying a carcass and cutting a slice, they can detect the least peculiarity in taste.

"*Cutting up Meat.*—The mode of cutting up meat is more diversified even than the slaughtering; but as London is the great emporium of the export meat trade, the method of cutting up meat in the metropolis should constitute the particular study of the shippers of meat. In the carcass of any animal, an ox, for instance, there are different qualities of meat, and these qualities are situated in different parts of the carcass. All the best parts are, in London, used for roasting and steaks, and the inferior for boiling, either in pieces, or making stock for soups, or minced meat, in the various forms of pies, sausages, &c.

"The carcass of an ox is cut up into the following pieces, as may be seen on referring to the numbers on the annexed cut (*Fig.* 1).

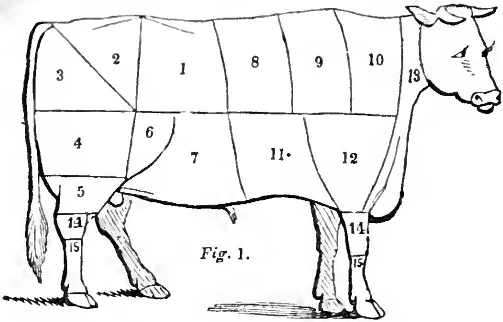


Fig. 1.

Hind Quarter.

1. Loin.
2. Rump.
3. Itch or adze-bone.
4. Buttock.
5. Hock.
6. Thick flank.
7. Thin flank.
8. Fore rib.

Fore Quarter.

9. Middle rib.
10. Chuck rib.
11. Brisket.
12. Leg-of-mutton piece.
13. Clod and sticking and neck.
14. Shin.
15. Leg.

"The relative value of these different cuts of an ox may be stated at their current value, namely, when the rumps, loins, and fore ribs of a fine ox fetch 8*d.* a pound, the thick flank, buttock, and middle rib will fetch 6*d.*; the itch or adze-bone, thin flank, chuck rib, brisket, and leg-of-mutton piece, 5*d.*; the clod and sticking, and neck, 3*d.*; and the legs and shins, 2*d.* a pound. Such is the difference in value of the different cuts of an ox in the meat markets in London.

"As an object of comparison, we shall also give a figure of an ox cut up in the New-York method, as in *Fig.* 2, and the great difference between both methods may be seen at a glance. It is from the American Agriculturist. The prices are those asked in the New-York market, January, 1845.

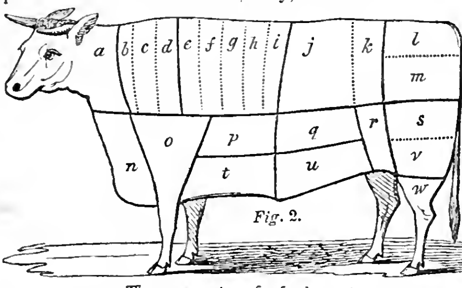


Fig. 2.

The ox as cut up for fresh meat.

"*a.* Neck, for corning or mince meat; price, 2 to 3 cents per lb.

"*b, c, d.* Chuck rib, for roasting pieces or steaks. It is sometimes left in one whole piece, for large roasts for hotels or public dinners, and sometimes cut in two pieces only. If the animal be small, it may, for moderate roasting cuts, be divided into two only; price, 7 cents per lb. for roasts, and 8 cents for steaks.

"*e, f, g, h, i.* Middle or crop rib roasting pieces, also called prime ribs. They are sometimes left in two or three pieces, only for the same reason as the chuck rib; price, 9 cents per lb.

"*j.* Sirloin or tenderloin steaks. It is cut into thin slices, for steaks, as wanted. Steaks should not be cut to the required size until they are to be put on the gridiron, as they thus lose their juice; price, 9 to 10 cents per lb.

"*k.* Sirloin roasting piece; price, 9 cents per lb.

"*l, m.* Rump steaks. The steaks from *l* are nearly (perhaps quite) as good as those of the sirloin; these pieces are also corned. If the steaks be cut from *l* only, they are worth 7 to 8 cents; if from *l* and *m* together, 6 cents per lb.

"*n, t.* Brisket, for corning, and the finest corning beef in the animal, when there is a full, deep brisket. These pieces are subdivided before corning; price, 5 cents per lb.

"*o.* Shoulder, or arm, for soup and mince meat; also corned; price, 2 to 3 cents per lb. It is sold, ordinarily, by the piece.

"*p.* Cross-piece, for roasting, and also cut for steaks; it makes a good corning piece. From the cross-piece is cut the shoulder clod; cross-piece is worth 6 cents; shoulder clod, 5 cents per lb.

"*q.* Plates for corning. When corned, it is cut smaller; price, 5 to 6 cents per lb.

"*r.* Flank, for corning; price, 4 to 5 cents per lb.

"*s, v.* Thigh or round, for beef *à la mode*; *s*, worth 5 cents, and *v*, 4 cents per lb.

"*u.* Navel, for corning: to be cut smaller before corning; price, 5 to 6 cents per lb.

"*w.* Shank, for soup, or mince meat, or corning; price, 2 to 3 cents per lb., or sold by the piece. This, as well as the shoulder or arm piece, *o*, makes poor corned beef, and is more economically used for soups; and, after serving that purpose, may be made into mince meat or hash.

"Sometimes it is desirable to corn nearly the whole of the quarter for dried beef. If so, *m, s*, and *v* are left in one piece, *l* and *w* being taken off; *l* is made into steaks or corned, and *w* into soup or mince meat. The balance of the thigh, consisting of *m, s*, and *v*, is cut into long, narrow pieces, from the upper part of the thigh down; they are broad at top, and run to a point below. When corned, they are hung up to dry and smoke, and should be hung up by the *small* or *lower* end.

"*e, f, g*, are the primest roasting pieces in the carcass; next come *c, d, h, i*; then *k*; then *b*. Many persons prefer *k*, the sirloin roasting piece, to all others; but a true epicure in beef always chooses the rib cuts; and of the rib cuts, the crop ones are far the finest.

"The butchers ask most for *e, f, g, h, i, j, k*. They are about equal in price; but *e, f, g* are more valuable for roasts, and *h* for steaks. Prices vary according to the goodness or badness of the animal; as he may be good in his chine and crops, and bad in his loins and rumps; or the reverse; or equal in both; also, according to the knowledge of the butcher, founded on the fancy of his customers. The highest price is always asked for sirloin steaks when cut by the butcher. Next come *b, c, d*, chuck rib roasting pieces and steaks, and *l*, the rump steaks; then *m*, lower part of rump, *p*, cross-piece, *q*, plate, and *u*, navel; *r*, flank; *s*, round; *n, t*, brisket; *v*, lower round or thigh; *a*, neck; *o*, shoulder; and *w*, leg.

"We would respectfully suggest to all our readers to follow the above directions in cutting up their beef. It is the most economical, as proved by long experience, and will avoid *all waste*. It separates all the pieces properly, so that the good and indifferent are not joined. If a prime part be left coupled with an inferior one, and roasted, the prime only will be eaten, and much of the inferior wasted, or used in some other form, as for hash or mince meat. There are parts enough for those purposes that ought not to be wasted, and should not be corned. The roasting cuts and the steaks require the juiciest meat, with interspersed fat, making what is called marbling or sparkling cutting; and the fat should not be in separate masses, nor in great abundance. The prime parts are all juicy. For corning, beef should be fat; and the proper corning parts have fat in large, separate masses. If the proper corning piece be roasted fresh, the lean gets soaked with melted tallow, and the roast is worthless. When boiled, this does not take place. Judicious cutting is, therefore, of great importance.

"Sheep and swine are cut up nearly in the same manner as the ox, and have nearly the same relative value of the different parts."

"Veal is cut up, in London, in a different way from any other meat. The knife is drawn between the buttock and itch bone, and through the pope's eye, taking a sloping direction through the coarse end of the buttock, leaving a flap. The piece thus cut out is called a *fillet* of veal. It is like a round of beef, with a part of the thin flank left to be skewered around it. The round bone is taken out, and stuffing put into its place. When the itch bone and hook bone are cut from the loin, the piece is called a *chump* of veal. The hind quarter of veal thus consists of fillet, chump, loin, and leg. The fore quarter is cut in the same manner as mutton, having shoulder, breast, and neck. In Scotland veal is cut very much like mutton."

Jugged beef consists of the lean parts of the flanks, salted, and dried in the sun.

Curing Beef for Exportation to England.—"Beef is uniformly cut into eight-pound pieces, and cured, in all particulars, precisely as pork (see *Hog*), except a larger proportion of saltpetre is used in packing. Beef is almost entirely packed in tierces. For export, tierces only should be used.

"A tierce of prime India beef should contain 42 pieces, eight lbs. each, and weigh not less than 336 pounds nett. It should be made from well-fed bullocks, and contain 32 pieces of loins, flanks, rumps, plates, buttocks, and briskets; 10 pieces consisting of four chines, two mouse buttocks, two shells of rumps, two pieces cut close up to the neck, with bone taken out; no shins, thigh-bones, or necks. To be well salted, and capped with St. Ubes, or other coarse salt.

"A tierce of prime mess beef should contain 38 pieces of eight pounds, and weigh not less than 304 pounds nett. It should be made from prime fat cows or heifers; 28 pieces of prime, from loins and chines, with one rib in each, flanks, rumps, plates, briskets, and buttocks, with 10 coarse pieces, consisting of two neck pieces (not the scrag), two thighs or buttock bones, with some meat to them, two shells of rumps, two, or even four chines, not cut too close to the neck, and two shoulder pieces, with part of the blade bone in them, well salted, and capped with St. Ubes, or other coarse salt. The tierces, whether for beef or pork, must be made of well-seasoned oak, with eight wooden and three iron hoops on each end.

"No pains to be spared in preparing and putting up, as the neat and tasty appearance of the packages will ensure a more ready sale than if put up in a slovenly manner.

"It may be useful to see the mode of cutting up the carcass of an ox in London. The provisions exported from that metropolis rule the trade in the West India Islands, and in other distant places abroad. It is very proper, therefore, that American packers should understand the English methods.

"The relative value of the different cuts of an ox may be stated at their current value, viz.: when the rumps, loins, and fore ribs of a fine ox fetch 8*d.* a pound, the thick flank, buttock, and middle rib will fetch 6*d.*; the itch or adze bone, thin flank, chuck-rib, brisket, and leg-of-mutton piece, 5*d.*; the clod and sticking, and neck, 3*d.*; and the legs and shins, 2*d.* a pound. Such is the difference in value of the different cuts of an ox in the meat markets in London.

"It is well to observe that the greatest attention should be paid to making the brine or pickle, whether for beef or pork. Pure water should be used in its manufacture; for the sediment from that which is impure will settle down upon the meat, and give it a bad colour and a slimy feel. Whether river or rain water is used (and soft water should always be preferred), it would be exceedingly desirable to filter it through sand, or, at least, to strain it. A great deal of beef and pork is utterly unfit for exportation by the use of unfiltered water in making the brine.

"In packing provisions, the tierces, barrels, &c., should be made with great care and neatness. Clean, handsome ash staves are preferred, and of such other hard, close-grained woods as will not stain the meat. Tierces should have four iron hoops, or three—one at each bilge and one at each chime; barrels, with an iron hoop at each chime. The fuller hooped the barrel or tierce is, the better."

MECHANICAL POWERS. The simple machines, the lever, pulley, wheel and axle, rope machine, wedge, and screw.

MECHOACAN. *Convolvulus panduratus.* Wild potato vine. A perennial, herbaceous bindweed, with tuberous root, of a slightly cathartic property.

MECONIC ACID (from *meconium*, *opium*). The acid with which morphia is combined. It is tribasic, white, crystalline, acid, and soluble in water and alcohol: the solution turns red when a per salt of iron is introduced into it. Formula, $3\ HO\ C_{14}\ HO_{11} + 6\ HO$ (Graham), with 6 atoms of water of crystallization. *Comenic* and *pyro-meconic* acids are derivatives.

MECONIUM. Opium. The excrement found in the intestines of new-born animals.

MEDIASTINUM. The portion of the cavity of the chest made by the folding of its membrane (pleura).

MEDIC. The genus *Medicago.* The principal species is the *M. sativa*, lucern. They are mostly small annuals, with minute leguminous flowers, are all very nutritious and readily propagated. *M. lupulina*, or black medic, is indigenous, but small; *M. falcata*, yellow medic, has been recommended for cultivation, and is hardier, although not so luxuriant or succulent as lucern: it is perennial. They all prefer a dry, calcareous, or marly soil.

MEDICINES FOR CATTLE. See *Pharmacopœia.*

MEDIUM. In science, the substance in which any body is immersed. It is called rare, dense, opaque, or transparent, according to its nature. It causes resistance to motion, and, more especially, acts upon the passage of light, bending (refracting) it from its straight course. Astronomers are disposed to admit the existence of a very rare medium or ether beyond the earth's atmosphere, filling the space of our solar system.

MEDLAR. *Mespilus Germanica.* A European tree resembling the pear; the fruit is about two inches in diameter, and flattened; it is very hard and austere until decayed, when it becomes of a pleasant acid sweetness. The Dutch and Nottingham varieties are best; but as the fruit keeps only for a short time when ripe, and is in no way handsome, it is but little cultivated. The wood is hard and tough, resembling that of the apple and pear. It is propagated in the same way as these trees.

MEDULLA. Marrow, pith, the pith of herbaceous plants. The *medulla oblongata* is the uppermost portion of the spinal marrow, which is sometimes called the *medulla*, and its membranous coverings the *medullary sheath.* The same term is used in botany to designate the vessels surrounding the pith of exogenous plants.

MEDULLARY RAYS. The silver grain of wood, a prolongation of the pith of trees from the centre to the bark, in exogens.

MEDULLARY SUBSTANCE. The white, internal portions of the brain. *Medullary tumours* contain a substance of the same appearance.

MEDULLIN. The pith of plants; the cellulose of Payen, to a considerable extent.

MEERS, MERES. Pools, lakes, ponds.

MELASOMES, MELASOMA. A tribe of heteromerous coleoptera, of a black or dark uniform colour.

MELASSIC ACID. The product of heat and alkalies on solutions of grape sugar; the acid of molasses.

MELIC GRASS. *Melica.* A genus of perennial, harsh grasses, but little esteemed. *M. speciosa* is the only indigenous species: it grows near Charlestown, South Carolina. Some species are made into domestic brooms and baskets in Europe.

MELILOT. *Trifolium officinale.* "The melilotus, or honey-lotus of botanists, so called from its smell, is a tall, yellow-flowered annual. It has loose racemes of small flowers, formed like those of clover, of which it was once regarded as a species. The melilotus has long roots, and a branching stem two or three feet high. It grows wild in woods, hedges, and neglected fields. When cultivated in a dry soil and made into hay, it has a powerful aromatic smell, and, mixed in a small proportion with meadow hay, gives it an agreeable flavour. This plant is used in making the Swiss cheese called Schabzieger. It is ground in a mill, and mixed with the curd into a kind of paste, which is put into conical moulds and there dried.

"The white or Siberian melilot (*M. alba*) rises several feet high, with a strong, branching stem, often six feet high. It was strongly recommended by Thouin, in a memoir addressed to the Agricultural Society of Paris in 1788, and has been tried occasionally with some success by various agriculturists, without, however, having been so generally adopted for cultivation as might have been expected from the high encomiums passed upon it. It will bear four cuttings in the year, and produces a very great quantity of green fodder. It should be cut before the stems become woody, and thus it will continue several years in the ground, although it is naturally only biennial. A light and moist soil suits this plant best. It is thoroughly acclimated."

MELILOTUS MAJOR. *Bokhara clover.* See *Clover.* It grows nine feet high, but becomes woody when above two feet.

MELLIPHAGANS (from *μελι, honey*, and *φαγω, I eat*). A family of birds (*Tenuirosters*), some of whom feed on honey.

MELOE. A genus of coleopterous insects. The wings are wanting; the outer cases oval or triangular; abdomen large. They crawl on the ground and low plants, and are remarkable for the blistering power they possess.

MELOLONTHIANS. The family of coleopterans to which the May-bug, or cockchaffer, belongs (*Melolontha vulgaris*).

MELON. *Cucumis melo.* An Asiatic fruit, of the family *Cucurbitaceæ*, much improved by cultivation. The best varieties are *Skillman's netted*, green-fleshed citron, green-fleshed nutmeg, large yellow cantaleup, green-fleshed Persian, pineapple, and musk-scented. The first is, for the most part, cultivated for the New-York market. The varieties of melon require a rich, sandy soil; it should be well prepared and rich, a spade of old dung being dug into the place where the seeds are dropped. Sow in shallow hills, five or six feet apart each way, soon in May. Six to ten seeds to the hill will be enough, one ounce serving for 100 hills: plant over in ten days, if the seeds fail. They are to be managed like cucumbers, two or three plants being left in the hill. When fine fruit is preferred to great numbers, the branches should be summer-pruned after a few melons are set; otherwise, when many are required, the first fruits, near the centre, should be plucked off. The fruit ripens in six weeks: it should part from the stem readily, be very fragrant, and well cracked or marked.

Never plant melons near other cucurbitaceæ, and keep choice kinds quite separate. The Persians cover the young melons with leaves and a little earth, to obtain them larger and more tender. An acre, well planted, will produce 400 bushels of cantaleups. Guano and a compost of fowl dung are especially reputed as manures for melons.

MELON, WATER. *Cucurbita citrullus.* Varieties: New-Jersey, Carolina, dark-skinned Spanish, Goodwin's imperial.

They require a loose, dry, sandy soil, made rich as for the muskmelon; hills six to eight feet apart. An ounce of seed serves for forty or fifty hills. The skins make good preserves with spices. The juice is fermented into a beer in some parts of Europe: when boiled down to a proper consistence, it makes a good sirup.

MEMBRANE. The tissue or expansion of animal or vegetable matter surrounding the bones and lining cavities. That lining the intestinal and urinary apparatus is mucous. The fibrous membrane covers all the bones and many muscles; and the serous tissue exists on the outer surface of the lungs and intestines, &c.

MENDING. Improving the texture or quality of land.

MENISCUS. A lens, concave on one side and convex on the other.

MENISPERMIC ACID. An organic acid in *Cocculus Indicus.*

MENSTRUUM. Any fluid which dissolves a given solid.

MENSURATION. The admeasurement of the contents of solids or areas of surfaces.

MENTUM. The chin. The lower and anterior portion of the under jaw of animals.

MENYNGES, or MENINGES. The membranes which cover the brain.

MEPHITIS. A noxious vapour; hence mephitic.

MERCURY. Quicksilver, fluid, white, brilliant: sp. gr., 13·5; freezes at —40°; boils at 660°, rising in vapour unchanged; equivalent, 101·43; symbol, Hg. (*Hydrargyrum*). It is soluble in nitric acid, and the oxides combine with numerous acids. *Calomel* is a chloride of mercury; *corrosive sublimate*, a bichloride, has been used to preserve timber, and is one of the most fatal poisons.

MERCURY, MERCURIALIS. A genus of insignificant weeds.

MERIDIAN (from *meridies, midday*). A great circle passing through the zenith of any place and the North and South Pole, on which the sun comes at 12 o'clock. The magnetic needle lies nearly in the meridian, the departure from this line being called its variation east or west.

MERINO SHEEP. See *Sheep.*

MESENTERY. The membrane which binds the small intestines to the back bone; it is a fold of the peritoneum, and contains the vessels, nerves, and absorbents, going to or from the bowels.

MESITE, MESITEN. Substances existing in wood spirit.

MESITYLENE. An oily product from acetone.

MESLIN. In Spain, a union of flocks; more commonly a mixture of seeds sown together, as wheat and rye, oats and pease, &c.

MESO (from μεσος, *middle*). An affix to many compound words, meaning the middle.

MESOCOLON. The membrane surrounding the colon.

MESOPHYL (from μεσος, and φυλλον, *a leaf*). The central layer of the leaf; we have also *mesocarp*, the fleshy part of the fruit.

MESOTHORAX (from μεσος, and θωραξ, *the chest*). In entomology, the posterior segment of the thorax, bearing the second pair of wings and third pair of legs.

MESOTYPE. The silicate of alumina and soda; it occurs in trap and ancient lavas.

MESTA. A mixture of flocks.

META (from μετα, *between*). A prefix to many compound words.

METABOLIANS. Insects which undergo complete metamorphosis.

METACARPAL. That portion of the hand between the fingers and wrist; *metatarsal* is the same part in the foot.

METAGALLIC ACID. Gallic acid changed by heat; its formula is $C_{12}\ H_3\ O_3$.

METALLOID. Potassium, sodium, and other alkaline metals; it is sometimes applied to the inflammable elements, as sulphur, phosphorus.

METALS. Elementary bodies, remarkable for their lustre; they conduct electricity and heat, and are negative electrics. The following table gives their names, specific gravity, and melting points:

Names of Metals.	Specific Gravity.	Melting Points.
		Fahr.
1. Gold	19·25	2016°
2. Silver	10·47	1873
3. Iron	7·78	2800? Smith's forge.
4. Copper	8·89	1996
5. Mercury	13·56	—39
6. Lead	11·35	612
7. Tin	7·29	442
8. Antimony	6·70	—
9. Bismuth	9·80	497
10. Zinc	7·00	773
11. Arsenic	5·88	—
12. Cobalt	8·53	2810?
13. Platinum	20·98	oxyhydrogen blowpipe.
14. Nickel	8·27	2810?
15. Manganese	6·85	Smith's forge.
16. Tungsten	17·60	—
17. Tellurium	6·11	620?
18. Molybdenum	7·40	oxyhydrogen blow-pipe.
19. Uranium	9·00	
20. Titanium	5·30	
21. Chromium	—	
22. Columbium	—	
23. Palladium	11·50	
24. Rhodium	—	
25. Iridium	—	
26. Osmium	—	
27. Cerium	—	—
28. Potassium	0·86	136
29. Sodium	0·97	190
30. Barium	—	—
31. Strontium	—	—
32. Calcium	—	—
33. Cadmium	8·60	442
34. Lithium	—	—
35. Silicium	—	—
36. Zirconium	—	—
37. Aluminum	—	—
38. Glucinum	—	—
39. Yttrium	—	—
40. Thorium	—	—
41. Magnesium	—	—
42. Vanadium	—	—

METAMORPHOSIS (from μετα, *change*, and μορφη, *form*). Transformation. In entomology, the changes the metabolian insects pass through of larva, pupa, and imago. In botany, the doctrine that the flowers, stamens, carpels, and seeds are modifications of the leaf.

METAPHOSPHORIC ACID. See *Phosphorus*.

METASTASIS (from *μετα, change*, and *στασις, place*). The change of an affection or pain from one part of the body to another.

METAYER. A farmer who rents land at a certain proportion of the crop, usually half, the owner finding tools and animals.

METEOROLOGY (from *μετεορως, aërial*, and *λογος*). The science which treats of the physical changes occurring in the atmosphere, the formation of clouds, fogs, rain, winds, and the phenomena of lightning.

METEORITE, AEROLITE. The masses of metallic iron occasionally precipitated to the earth; they are supposed to be derived from the moon: showers of many hundreds have sometimes fallen together.

METEORS. The transitory phenomena occurring in the air; thus, *aërial* meteors are winds, tornadoes, &c.; *aqueous* meteors are rains, hail, fogs; *luminous* meteors are halos, rainbows, lightning, northern lights.

METHEGLIN. Mead.

METHOL. A hydrocarbon, obtained by distilling xylite with sulphuric acid.

METHYL. A volatile, combustible spirit, soluble in water, closely resembling alcohol, is obtained from wood, and contains this compound radical, symbol Me.; formula, $C_2\ H_3$; it has not been isolated. Numerous compounds of methyl are known.

MEZEREON. *Daphne mezereum.* A highly ornamental shrub with pink flowers, the spurge laurel: the whole plant is poisonous. It is readily cultivated, although exotic.

MEZZANINE. In architecture, a low story introduced between two taller ones.

MIASM. Malaria, infectious vapours from marshes, &c.

MICA. Isinglass, silver. A bright laminated mineral of every colour, elastic, and more or less transparent. An ingredient in granite and most ancient rocks, often occurring in large sheets, and used as a substitute for glass. It consists of silica, 42; alumina, 16; magnesia, 25; potash, 7½; manganese, iron, &c., 9·5 in 100 parts.

MICA SLATE. A transition slate, full of bright specks of mica mixed with quartz.

MICROMETER. An instrument affixed to microscopes and telescopes for measuring the size of objects.

MICROPYLE. In botany, a small hole over the apex of the nucleus of a seed.

MICROSCOSMIC SALT. Phosphate of ammonia and soda, used in blowpipe analysis.

MICROSCOPE (from *μίκρος*, *small*, and *σκοπεω*, *I view*). An optical instrument which enables us to see and examine objects which are too minute to be seen by the naked eye. Microscopes are single or compound, according to the nature of their construction; a single microscope being one through which, whether it consists of a single lens or a combination of lenses, the object is viewed directly; and a compound microscope one in which two or more lenses are so arranged that an enlarged image of the object formed by one of them is magnified by the second, or by the others, if there are more than two, and seen as if it were the object itself. A single microscope is no more than a magnifying glass.

MIDDEN. A dung heap.

MIDDLE RAIL. The central rail of the door, on which the lock is placed.

MIDRIB OF A LEAF. The central collection of woody fibres and vessels; the prolongation of the leaf stem.

MIDRIFF. The diaphragm; the muscle which divides the cavity of the chest from the abdomen.

MIGNONETTE. *Reseda odorata* An annual, but may become perennial by keeping in a hot-house during winter and pruning.

MIGRATORY. Of the habit of migrating or moving with the season to the north or south, as numerous birds and fishes.

MILDEW. This is a thin and whitish coating with which the leaves of vegetables are sometimes covered, occasioning their decay and death, and injuring the health of the plant. It is frequently found on the leaves of hop, pea, hazel, fruit-trees, and the white and yellow dead-nettle; it is found also on wheat, in the shape of a glutinous exudation, particularly when the days are hot and the nights without dew. J. Robertson (*Hort. Trans.*, v., 178) considers it as a minute fungus, of which different species attack different plants. Sulphur he has found to be a specific cure. In cultivated crops mildew is said to be prevented by manuring with soot; though by some this is denied, and soot, by rendering the crop more luxuriant, is said to be an encourager of mildew, the richest parts of a field being always most infected by it. As it is least common in airy situations, thinning and ventilation may be considered as preventives.

Liming, the use of salt, and saline manures generally act as preventatives. The varieties of mildew are many, the *Puccinia graminis* being that affecting wheat and grasses. See *Uredo*. The effects of mildew and blight have sometimes been averted by lighting fires to windward, so that the smoke swept over the field, and

Fig. 1.

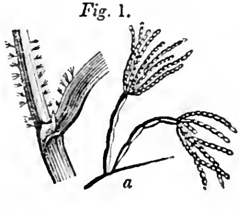
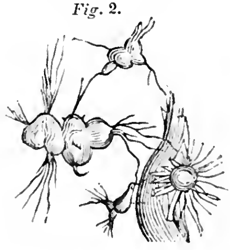


Fig. 2.



also by drawing a rope through the field and moving it across the wheat or grain in the morning when the dew was on the plants in dull weather. One of the commonest forms of the white mildew that covers leaves is that of the *Aspergillus* (*Fig.* 1): *a* is the plant enlarged. The mildew of roots, which destroys potatoes, &c., is usually the *Rhizoctonia* (*Fig.* 2).

MILE. 1760 yards. The sea mile is 1-60th of a degree, or 2025 yards.

MILFOIL. *Achillea millefolium.* Yarrow. A common flowering plant in meadows, marking a good soil.

MILIARY. Granulated, like many small seeds.

MILK. The secretion of the mammary glands, but especially that from the cow. Its composition varies somewhat, but averages per cent., of curd or casein, 4·5 parts; of butter, 3·2; milk-sugar, 4·8; saline matters, ·60; water, 86·9. The butter is held in suspension in the milk, but separates when it is heated or much shaken. The specific gravity of fresh milk is 1·03. The flavour and quality of milk vary much with pasture and food; it is also affected by cleanliness. See *Butter*, *Cheese*, *Cow*. Milk may be kept for a long time sweet if heated in bottles to 180° Fahrenheit and tightly corked while the steam is issuing, and immediately after removing it from the fire.

MILK FEVER. Puerperal fever. "Cows in high condition are most subject to this fever. This inflammatory disease sometimes appears as early as two hours after parturition. If four or five days have elapsed, the animal may generally be considered safe. On the appearance of the fever, from six to ten quarts of blood should be taken, according to the age and size of the animal. The bowels must be opened, or the disease will run its course; and purging once established in an early stage, the fever will, in the majority of instances, rapidly subside, leaving the strength of the constitution untouched." Calomel purges are best in the first stage.

MILK CELLARS. Dairy.

MILKING. "When you milk, take a vessel of cold water and sponge. Wash the udder and teats clean, dashing on the cold water. This will prevent the teats from becoming sore, and the udder hot and feverish. Milk with clean hands. The whole business of milking is frequently conducted in such a slovenly manner that the milk is entirely unfit for food. The cow should be milked while eating her fodder at morning and evening. She should always be milked and fed at the same time in the day, and uniformly by the same person. Milk without interruption. Be sure to milk the cow as dry as possible. To be milked by different hands, at different times in the day, in a slow, interrupted manner, and leaving part of the milk in the udder, will ruin the best cow in the world. If the cow have sore teats, foment them before milking with warm water, and afterward dress them with the following salve: Melt together one oz. of yellow wax and three oz. of lard, and as these begin to get cool, rub in a quarter of an oz. of sugar of lead, and a drachm of finely-pounded aloes."—(*Youatt.*)

MILK SICKNESS. Trembles. A frightful, contagious disease, attacking the cattle of certain districts of the Western States, more especially Indiana and Illinois: one of the infected districts lies for 100 miles near the banks of the Wabash. The animals are poisoned by some article of food or drink; their breath is fœtid, eyes blood-shot, gait staggering and wild; when driven, they fall into convulsions, and frequently die. The milk, butter, cheese, and meat of such animals are highly poisonous, two or three ounces bringing on the same disease in man and other animals in from six hours to four days. In man it commences with fœtid breath, general uneasiness, lassitude, loss of nervous power, vomiting frequently with blood, loss of appetite, constipation, loss of biliary secretion, and, finally, all the symptoms of low typhus fever, with nervous tremours and delirium, the brain and meninges becoming inflamed: it is very fatal. The cheese and butter of the infected districts are abundantly exported to St. Louis, Louisville, &c., and frequently produce fatal effects. It is probable that the extensive poisoning in this city (New-York) in the spring of 1840 arose from cheese imported thence.

The treatment is very doubtful, but should proceed as in typhus fevers, by sustaining the strength, and allaying nervous irritability.

There seems to be much connexion between this peculiar disease and the *malignant pustule*, which affects cattle in Europe, and occasionally the seaboard states, except only that it is said to be strictly local in places now infested, having been so for 100 years, as known to the settlers, and there is no pustule produced.

MILK PARSLEY. *Selinum palustre.* A perennial, herbaceous weed, growing in wet places in Europe; the roots are acrid, and said to serve the Russians for ginger.

MILK, SUGAR OF. See *Milk*.

MILK-TREE, COW-TREE. *Palo de leche*, *Galactodendron dulce.* A tree of Upper South America (Caraccas), of the same family as the fig (*Urticaceæ*). The sap obtained by tapping is precisely like milk, and very palatable; it contains a creamy matter like bees' wax, fibrin, sugar, an acid, salts, and water. Other trees about Maracaibo yield good milk, as the *Clusea galactodendron.* In the East, at Ceylon, the *Tabernæmontana utilis* also yields a good milk. The milky juice of most plants is acrid, and often very poisonous.

MILK VESSELS. In plants, the anastomosing tubes lying in the bark or near the surface of plants, in which a white turbid fluid is secreted; they are one of the forms of the *vital veins* (*laticiferous*) of Schultz, the fluid being called the *latex*.

MILK VETCH. Plants of the genus *Astragalus:* they are leguminous, wholesome weeds. The *A. bœticus* is cultivated for its seeds, which resemble coffee.

MILK WORT. Plants of the genus *Polygala*, mostly annuals, with pretty leguminous flowers; the roots are often medicinal, especially the *P. Senega*, or snake-root.

MILL. A machine in which various substances are crushed or ground by a rotatory motion. See *Grist Mill*, *Oil Mill*.

MILLEPEDE. The thousand feet; the centipede.

MILLET. Several distinct plants are known under this name, two of which are much cultivated, viz., the common millet (*Panicum miliaceum*), and the doura or Indian millet (*Sorghum vulgare*). Besides these, there is a Polish millet (*Digitaria sanguinalis*), German millet (*Setaria Germanica*), and Italian millet (*S. Italica*), of which the Polish only is at all cultivated now.

Common millet rises from three to four feet high, is like a reed, and bears a large loose panicle of seeds hanging on one side.

"*Culture.*—This plant will grow upon any soil of tolerable richness, though it does best on a loam. The ground should be prepared as for ordinary crops. The seed may be sown broad-cast, and covered with the harrow. If sown early, the crop may be gathered in August, though if sown any time before the 25th of June it will come to maturity. If seed is the object, four quarts of seed to the acre will be enough; but if intended principally for cattle feed, the quantity of seed may be increased to eight quarts. Birds are fond of the seed, and devour it as soon as it begins to ripen; the crop should be, therefore, cut before the whole has matured, and while the straw is green. It may be cut with a sickle, scythe, or cradle, and should be housed as soon as it is sufficiently dry.

"*Product.*—The product will be according to the soil, and will vary from 10 to 30 bushels of seed, and from one to three tons of forage on the acre. It sometimes produces more than a thousand fold return.

"*Use.*—We have found it an excellent substitute for corn in fattening hogs, either ground or boiled, and its early maturity renders it particularly useful for this purpose. It is an excellent food for poultry, pigs, and, if ground, would probably be useful for neat cattle and horses. The straw is eaten freely by cattle, and both the seed and straw abound in nutritious matter."

Indian Millet. — This plant very closely resembles broom corn, except that the seeds are collected together in a bunch at the top of the stalk. It grows from five to seven feet high; the seeds are round, yellowish, and easily thrashed. It requires the same management as Indian corn, but may be sown in much closer drills. It often yields 80 bushels per acre of seed, besides an abundant straw. The grain is good fodder for horses, cows, pigs, and poultry, and forms nearly the only breadstuff of the Arabians. The meal is very much like that of corn. Eight quarts of seed are enough for the acre: it is sown in May on land prepared as for corn.

MILLET GRASS. *Milium.* The only species which appears to be cultivated is the *M. effusum*; this is perennial, from four to eight feet high, with a loose, spreading panicle: it very much resembles the panic grasses. If the seed is sown in the fall broad-cast, and raked in, it will ripen in the following July. It is indigenous.

MILL-STONE. See *Buhr-stone.* Conglomerates, or sandstones, are sometimes used for coarse purposes, but should not be set up for flouring.

MILL-STONE GRIT. A geological formation immediately under the coal, and made of beds of coarse quartzoze sandstone.

MILSEY. A sieve in which milk is strained.

MILVINES. A family of raptorial birds, of which the kite (*Milvus*) is a member.

MIMUS. The genus of passerine birds, of which the mocking-bird (*M. polyglottus*) is a species.

MINDERERUS SPIRIT. Solution of acetate of ammonia, a febrifuge.

MINERALOGY. The science which has for its object the examination and description of minerals.

MINIM. A measure equal to a drop of water: there are sixty minims in a fluid drachm.

MINIUM. Red-lead, used in painting.

MINT. The genus *Mentha*, but, especially, the *M. viridis*, or green mint; a well-known fragrant perennial, of the natural family *Labiatæ*, used in juleps, with pease, &c. The *M. piperita* yields the valuable peppermint oil.

All the mints are creeping-rooted perennials; they require a rich, moist soil, and, when cultivated for their oil, are grown in beds with trenches between them for irrigation. They are propagated from pieces of stem, set in rows six inches apart each way, in April: the third year gives a full crop, which is continued for five or six seasons. The plants are cut as soon as the flowers expand, and distilled while fresh, with a large quantity of water, the essential oil passing over with the steam, and floating on the cooled distilled water: the latter forms the best peppermint water.

MINUS. Less, distinguished by the mark —, and used in physics to designate quantities below a standard; thus, all degrees of temperature below zero (0) are minus, and read minus 50, —30, &c.

MIOCENE (from *μειων, less*, and *καινος, recent*). The intermediate portion of the tertiary epoch, in which some seventeen per cent. of recent shells are discovered.

MIRAGE, FATA MORGANA, LOOMING. An optical delusion, in which ships and objects at sea appear depicted against the clouds.

MIRROR. A looking-glass, speculum, or any polished surface, used as a reflector. Mirrors are plane, concave, or burning (magnifying), and convex, or minifying.

MISCARRIAGE. See *Abortion.*

MISLETOE. *Viscus album, verticillatum.* Shrubby, parasitical plants, growing occasionally on large trees. Many fabulous virtues are attributed to it; sheep are said to be very fond of the leaves. The white berries make good birdlime, when prepared.

MIST. Fog.

MITES. Wingless insects of the genus *Acarus*, inhabiting animal matters in certain stages of decay. The cheese mite is the *Acarus domesticus.*

MITRAL VALVES. The valves of the left ventricle of the heart.

MITRE. In building, the junction of two pieces of wood, &c., by cross fitting.

MOCKING-BIRD. A species of thrush. See *Mimus.*

MIXEN. A compost.

MOBILITY. Capacity for movement, mobile.

MODILLON. An ornament, or scroll, placed at intervals under the corona.

MOHAIR. The silky hair of the Angora goat, used for camlets and other costly stuffs.

MOLARS, MOLARES (from *mola, a mill*). The grinding teeth, placed behind the incisors.

MOLASSE. A soft, green sandstone, of the miocene epoch, found in Switzerland

MOLASSES. The thick, dark fluid which runs from the Muscovado sugar; it consists of uncrystallizable sugar, an acid, aromatic bodies, and water: when fermented, it yields rum by distillation. But under this name the refuse of the sugar-house is also sold, a compound which is more correctly called treacle. The inspissated juice of the corn, maple, &c., is also called molasses by some persons.

MOLE. The American mole is the *Scalops aquaticus*, an animal distinct from the European (*Talpa Europea*). Moles live in pairs, in rich soils abounding in worms, slugs, and insects, upon which they feed: they do much good in this way, and should not be disturbed unless in great numbers. They may be destroyed by setting traps in their paths; the trap is no more than a half cylinder of wood made hollow, each end of which should be furnished with a ring containing a noose, or loop, of horse hair; these are loosely fastened in the centre by means of a moveable peg, and the hair stretched above the ground by a bent stick capable of springing up. As the mole passes, he forces the central peg away when half through the trap, and the spring above, acting on the hair, draws it tightly and strangles the animal.

MOLE CRICKET. *Achcta gryllotalpa.* Earth crab. A kind of cricket, with a remarkable hand like a mole, by which it burrows in the soil; it devours the roots of plants, and is often very injurious to meadows: when found, they should be killed.

MOLECULE. An atom not capable of being reached by mechanical subdivision.

MOLE PLOUGH. A plough provided with a deep sharp foot beneath the sole to penetrate the earth. See *Draining.*

MOLE-TREE. *Euphorbia lathyrus.* Spurge caper, epurge. A biennial herb, the fruit of which, when half ripe, is pickled for capers. It is an acrid plant, and was supposed to be injurious to moles.

MOLLITES (from *mollis, soft*). A disease of the bones, hoofs, &c., in which they become soft, and often flexible.

MOLLUSKS, MOLLUSCA. The animals inhabiting shells, and those of similar conformation, but without that covering: they are of low organization, and cold-blooded.

MOLYBDENUM. A rare metal, not used in the arts.

MOMENT, MOMENTUM. The available force of a moving body at any time; its velocity multiplied into its weight.

MONADELPHOUS, MONODELPHIA (from *μονος, one*, and *αδελφια, a fraternity*). Flowers in which the stamens are united into one mass by their filaments.

MONANDROUS, MONANDRIA (from *μονος*, and *ανηρ, male*). Plants or flowers having one stamen only.

MONAS, plural MONADS. A genus of extremely minute simple polygastric infusorials.

MONILIFORM. Resembling a string of beads.

MONKSHOOD. *Aconitum napellus.* Wolfsbane, aconite. Handsome perennial-rooted plants, with large blue flowers, much cultivated. They are very poisonous and narcotic. An extract of the leaves of monkshood is used in medicine.

MONO (from *μονος, one, single*). An affix to many compound words.

MONOCHROMATIC (from *μονος*, and *χρωμα, colour*). Having but one colour, incapable of decomposition by the prism.

MONOCHLAMYDEÆ, MONOCHLAMYDEOUS (from *μονος*, and *χλαμυς, a coat*). Flowers with only one envelope, or perianth, as the tulip, lily. Those furnished with a calyx also, are called diclamydeous.

MONOCOTYLEDONS, MONOCOTYLEDONIA (from *μονος*, and *κοτυλεδων, lobe*). Endogens. Those plants and trees the seeds of which have but one lobe, as grasses and palms.

MONŒCIA (from *μονος*, and *οικος, a house*). The twenty-first class of Linnæus; plants which bear pistillate and staminate flowers, perfectly distinct, but on the same stem, as Indian corn.

MONOGYNIA (from *μονος*, and *γυνη, a female*). Flowers with one pistil.

MONOMERANS (from *μονος*, and *μηρος, a limb*). A section of the coleopterous insects, in which the tarsus is supposed to be formed of a single joint.

MONOPETALOUS. A corolla, the petals of which cohere into a tube: synpetalous, gamopetalous.

MONOPHYLLUS. A calyx with the sepals united. *Monosepalous* is used to indicate the same form.

MONOSEPALOUS. With the sepals of the calyx united into one tube.

MONSOONS. The periodical trade winds of the Indian Ocean.

MONSTROUS PLANTS, MONSTROSITY. Plants which by cultivation or otherwise have become changed from their original forms.

MONTANT. In building, any upright piece in framing.

MOON. The common notions of the operation of the moon on changes of weather, &c., have been often and fully proved to be erroneous: they are altogether destitute of truth.

MOONSTONE. *Adularia.* Semitransparent feldspar.

MOON TREFOIL. *Medicago arborea.* A species of medic.

MOONWORT. *Botrychium fumaroides.* An indigenous, unimportant fern.

MOOR. "A name given to extensive wastes which are covered with heath, and the soil of which consists of poor light earth, mixed generally with a considerable portion of peat. The want of fertility in moors arises chiefly from a deficiency or superabundance of moisture, the subsoil being either too porous to retain it, or too impervious to allow it to escape. Both extremes occur in some moors, which are parched up in dry weather, and converted into a dark mud by any continuance of rain. A considerable portion of iron is also generally found in the soil of moors, which is very hurtful to the vegetation of plants, except heath, furze, and other coarse plants, which almost entirely cover the moors. This iron is carried down through the light surface-soil, and, if it meets with a less porous earth below, is frequently deposited in a thin layer, cementing the particles of silicious sand, which are carried down with it, and forming what is called the *heath-pan* or *moor-band.* This substance is perfectly impervious to water, and wherever it exists in a continous state, all attempts at improvement are vain, till it is broken through or removed. The roots of trees occasionally find a passage through interstices or fractures of the pan, and then often grow luxuriantly. But wherever young trees are planted, without the precaution of breaking through the moor-band, they invariably fail, and disappoint the expecta tions of the planter, who, seeing fine, large trees growing around, naturally imagined that the soil was peculiarly fitted for them. If the stump of a large tree, which has been cut down. is grubbed up, pieces of the moor-band may often be seen all around the stem, at a short depth below the surface, so arranged as to show evidently that the tap-root, having found an aperture, and extending its fibres downward into a better soil, has, in swelling, broken the pan and pushed it aside. When the moor consists of a loose, peaty earth of little depth incumbent on a rock, as is the case in many mountainous countries, no art can fertilize it. In dry weather the whole surface has the appearance of a brown powder like snuff, which becomes a spongy peat as soon as it is soaked with rain. The hardiest heaths and mosses alone can bear this alternation; and where the substratum of rock is not broken into crevices through which the roots penetrate, all vegetation ceases except mosses and lichens.

"*Moss land* is often confounded with moor; but it is very distinct in its nature. Moss land is produced by the accumulation of aquatic plants, and its origin is chiefly vegetable. When it has a considerable depth, and its substance has lost all power of vegetation, it forms peat bogs of more or less consistency, as the water is drained off or retained in its pores. In the latter case it appears like a spongy vegetable mass, consisting almost entirely of fibres, so interwoven as to form a very light substance, in which water is easily retained, which keeps up a kind of internal vegetation, by which the quantity of the moss is gradually increased. This is the substance which covers the surface of bogs, and where it is of some consistence it allows a passage over them; but where it is very thin and loose it deceives the eye by an appearance of solidity, like that of a smooth, green pasture, which, however, gives way to the pressure of the foot, and allows it to sink through it with very little resistance. The only way to improve moss is to drain it, and then convert the vegetable matter of which it is composed into soil, by means of lime and pressure. The latter is effected by putting on a considerable quantity of earth, especially sand and gravel, which, incorporating with the moss; consolidates it, and assists the lime in decomposing the vegetable fibre. After this it becomes extremely fertile, producing abundant crops of potatoes and oats; and whenever it has acquired sufficient solidity by the treading of sheep and cattle, it will produce good crops of wheat, or, if laid down to grass, give abundance of hay and pasture. Trees do not thrive in mossy soil, there being too little solidity for the roots, and the large trunks which are frequently found in bogs must have grown before the moss was formed. This may be easily imagined. A wood laid flat by a storm or hurricane may obstruct the natural flow of the waters, and cause them to accumulate. The prostrate trees become surrounded by aquatic plants, which spread their fibres and roots freely through the water, and, decaying, make room for others. Thus the trees are gradually covered and buried in the moss till future generations find them, when the moss or bog is explored for fuel or for improvement. The trees which are found buried in mosses frequently show evident signs of having been gradually covered. The upper surface is often decayed and uneven, while the lower surface shows that it has remained submerged and protected from the contact and influence of the air, and has thus been preserved from rotting."—(*W. L. Rham.*)

MOOR-BAND PAN. The incrustation produced in some ferruginous soils. See *Moor*. The pan may be calcareous in limestone soils, and when not very hard can be destroyed by the subsoil plough.

MOOR GRASS. *Sesleria dactyloides.* An unimportant Southern grass.

MOOSE. *Cervus alces.* The largest of the deer genus. They live in troops in swampy places, and are confined to the northern portions of the States, and to Canada.

MOOSE ELM. The red elm.

MOOSE WOOD. *Acer striatum.* The striped maple. This term is also applied to the *Dirca palustris*, or leather wood.

MORAINE. The longitudinal masses of stones and rubbish found at the bases and along the edges of great glaziers, or in places where they have existed.

MORASS. Swampy moor land.

MORDANT. A substance which unites chemically with the fibre of wool, cotton, &c., and with the colouring matter also, forming with both insoluble compounds. See *Cotton Dyeing*. Acetate of alumina, alum, solution of tin, and pyrolignite of iron (red liquor) are the most important mordants.

MORDELLA. A genus of coleopterans, now the type of a family, *Mordellidæ*. They are heteromerans, with an elevated and arched body, low head, thorax semicircular, or trapezoid, elytra very short, pointed at the tips.

MOREL. *Morchella esculenta.* Latticed mushroom. An edible mushroom much esteemed in Europe, where it is stuffed with force-meat, and fried for the table. It grows in woods, has a wide, hollow stalk two inches high, with a yellowish or grayish ribbed head, of small width, and two or three inches deep.

MOROCCO LEATHER. The true sort is of goat's skins, tanned on the grain side; but sheep skins are often sold. The skins are first steeped in a fermenting mixture of bran and water for a few days, worked on the horse, steeped twelve hours in fresh water, and rinsed. They are then steeped in lime-pits until the hair can be removed, cleansed, and the surface dressed with hard schist to expel the lime. They are then worked on the horse-beam, and subjected afterward to a species of fulling by being agitated by pegs in a revolving cask with water.

The skins are again immersed a night and day in a fermenting bath, worked, and salted for dyeing. They are first mordanted by solution of tin or alum, two skins being sowed together to make a bag to hold the fluid, and the colour given by a solution of cochineal, in cream of tartar and water.

MOROXITE. A native phosphate of lime of a mulberry colour.

MOROXYLIC ACID. An acid found in the bark of the white mulberry-tree.

MORPHIA. The active narcotic principle of opium. It is extremely poisonous: composition, 72·34 carbon, 6·36 H. 5 N., 16·3 oxygen.—(*Ure.*)

MORPHOLOGY (from μορφη, *form*, and λογος, *a discourse*). The doctrine of the metamorphosis of plants, from which it appears that petals, stamens, and carpels are merely modified leaves; that their position and mode of development are similar with that of leaves. A seed is also analogous to a leaf bud.

MORTAR. "This is composed of quicklime and sand, reduced to a paste with water. When dry, it becomes as hard as stone and as durable; and adhering very strongly to the surface of the stones which it is employed to cement, the whole wall, in fact, becomes nothing else than one single stone. The bricks or stones should be dipped in water before mortar is added, otherwise it does not adhere to them so perfectly. But this effect is produced very imperfectly unless the mortar be very well prepared. The lime ought to be pure, completely free from carbonic acid, and in the state of a very fine powder; the sand should be free from clay, and partly in the state of fine sand, and partly in that of gravel; the water should be pure, and if previously saturated with lime, so much the better. The best proportions, according to the experiments of Doctor Higgins, are three parts of fine sand, four parts of coarse sand, one part of quicklime, recently slacked, and as little water as possible. The stony consistence which mortar acquires is owing partly to the absorption of carbonic acid, but principally to the combination of part of the water with the lime. This last circumstance is the reason that, if to common mortar one fourth part of lime, reduced to powder without being slacked, be added, the mortar, when dry, acquires much greater solidity than it otherwise would do. This was first proposed by Loriot; and afterward Morveau found the following proportions to answer best:

	Parts.
Fine sand	3
Cement of well-baked bricks	3
Slacked lime	2
Unslacked lime	2
	10

The same advantages may be obtained by using as little water as possible in slacking the lime. Higgins found that the addition of burned bones, in the proportion of not more than one fifth of the lime employed, improved mortar by giving it tenacity, and rendered it less apt to crack."

MORTAR, HYDRAULIC. "When a little clay is added to mortar, it acquires the important property of hardening under water, so that it may be employed by the farmer in places which are constantly exposed to the action of water. Limestone is found not unfrequently mixed with clay; and in that case it becomes brown by calcination, instead of white. These native limestones are employed for making *water* mortar; but good water mortar may be made by the following process: Mix together four parts of blue clay, six parts of black oxide of manganese, and 90 parts of limestone, all in powder; calcine this mixture to expel the carbonic acid; mix it with 60 parts of sand, and form it into a mortar with a sufficient quantity of water. The best mortar for resisting water is made by mixing lime with puzzolano, a volcanic sand brought from Italy. Morveau informs us that basalt, which is very common, may be substituted for puzzolano. It must be heated in a furnace, thrown while red-hot into water, and then passed through a sieve."

MORTIFICATION. Gangrene; the death of a part of the body. When it occurs in the limbs, a distinct line of separation of a red colour may be seen between the mortified and living parts; the limb should be removed as soon as possible above the healthy part. Mortification of internal organs, when extensive, is necessarily fatal; when it comes on, there is great loss of strength, freedom from pain, usually a disagreeable or gangrenous odour, delirium, cold sweats, and death. The lungs are most subject to gangrene, as a consequence of inflammation. *Sloughs* and *sphacelus* are small portions of gangrenous flesh removed from wounds.

MORTISE. The union of two pieces of wood or other substance, by introducing one into a hole made in the other: the former is called the *tenon.*

MORUS. The generic name of the mulberry, now often applied to the Chinese, or *M. multicaulis.*

MOSAIC WORK. Inlaying pavements, walls, &c., with small dies of different shapes, colours, and materials, more especially to represent historical subjects.

MOSSES. *Musci.* In common language, any minute, small-leaved, cryptogamic plants. Thus, club-moss is a lycopodium; Iceland and reindeer mosses are lichens, and the numerous species of Jungermannia are all comprehended under the same term; but in systematical botany, no plants are considered mosses except such as belong to the natural order *Bryaceæ* or *Musci.* Such plants are simple-leaved, without spiral vessels or stomata; with a distinct axis of growth, and with the sporules, or reproductive matter, enclosed in cases, called sporangia or thecæ, covered by a cap or calyptra; they have cases, called staminidia, containing powdery matter. None of the mosses are of any known use, except for the purpose of packing plants, and surrounding their roots when they are sent to a distance.

MOSS LANDS, or MOSSES. See *Moor.*

MOSS IN PASTURES. See *Meadows.* Scarifying and manuring with ashes form the most ready method of treating this defect.

MOTH. The perfect insect of an extensive class of lepidopterous insects, furnished with scaly wings. The household nuisances known under this name are usually of the tribe tineans (*Tineadæ*). The clothes moth is the *Tinea vestianella;* the carpet moth, *T. tapetzella;* the fur moth, *T. pellionella.*

They lay their eggs in the spring, and the moth dies immediately after; their eggs are hatched in 15 days; the white caterpillars begin at once to feed on the fabric, covering themselves with fragments of its texture, which they mould into a tube. With these protections they move about all the summer; in the autumn they fix their habitation, remain torpid in the winter, change to crysalids in spring, and some twenty days after, in May and June, come out as moths to lay their eggs in the evenings.

Preventives.—In spring bring out all the clothing, feathers, &c., subject to their ravages, expose them to the sun for some hours, taking care to brush and shake them thoroughly; by this means the insects are dislodged. When they are in the crevices of walls, &c., all suspected places should be reached with spirits of turpentine or tobacco smoke. There should be placed in clothes-drawers camphor, tobacco leaves, pennyroyal, and lavender; it is found, also, that cedar wood is offensive to moths. Where there is no cause against it, substances infested may be dipped in boiling water, or a solution of corrosive sublimate, which is a violent poison.

The *Tinea granella* sometimes attacks stored wheat and other grains, but they are destroyed by kiln-drying at 180° Fahrenheit.

MOTHER-WATER. In chemistry, the solution from which crystals have been obtained, and which furnish a second supply when evaporated.

MOTION. "In mechanical philosophy, motion is the change of place; that is, of the part of space which the body occupies, or in which it is extended. Motion is *real* or *absolute* when the moving body changes its place in absolute space; it is *relative* when the body changes its place only with relation to surrounding bodies; and it is *apparent* when the body changes its situation with respect to other bodies that appear to us to be at rest. All the phenomena of motion are derived by mathematical deductions from the three following laws of motion of Newton:

"1. A body must continue forever in a state of rest, or of uniform motion in a straight line, if it be not disturbed by the action of an external cause.

"2. Every change of motion produced by any external force is proportional to the force impressed, and in the direction of the straight line in which the force acts.

"3. Action and reaction are equal, and in contrary directions; that is, equal and contrary changes of motion are produced on bodies which mutually act on each other."

MOTOR. Producing motion.

MOTTLED. *Maculatus.* Stained with coloured blotches or dots

MOULD. Finely divided soil, rich in vegetable matter: it is to be distinguished from decayed leaves, &c., which constitute vegetable mould or humus.

MOULD-BOARD. The large curved side of a plough, which turns the furrow slice.

MOULDEBÆRT, MOLLEBART. A Flemish levelling machine, figured in the article *Barren Lands.*

MOULDINESS, MOULD, MILDEW. Minute cryptogamic plants, of a grayish aspect usually, but of all colours, which appear upon damp linen, cotton, and vegetable substances, as bread; they belong to the genera *Aspergillus, Mucor,* and other mucedines, and are to be avoided only by dryness, and proper exposure to the sun and dry air. The genera which appear on plants, as the hop, pea, &c., are very numerous.

MOULDING. The curved or straight lines, or fillets, used in architecture, as decorations, or members of the common orders.

MOULTING. Change of plumage. It takes place annually for the entire plumage, and also partially where feathers of new colours are produced.

MOUNTAIN ASH. *Pyrus aucuparia.* Rowan-tree. A handsome exotic shrubbery-tree, with beautiful bunches of red berries, which are occasionally prepared by soaking in water, and preserved as a sweetmeat.

MOUNTAIN LAUREL. *Kalmia latifolia.* A handsome shrubbery plant; the flowers are poisonous. It sometimes grows to 15 or 20 feet.

MOUNTAIN LIMESTONE. The strata of this material immediately below the coal measures.

MOUNTAIN MAHOGANY. *Betula lenta.* The black birch.

MOUNTAIN RICE. *Oryzopsis asperifolia.* A perennial, native of the South; culm almost naked, leaves rigid, erect, and sharp at the point; flowers in a panicle; height 18 inches: flowers in May.

MOURAT. A name given to the brown wool of some sheep.

MOUSE. Several species of the genus *Mus*, of the family *Rodentia.* They are the food of cats, the terrier family of dogs, hedgehogs, snakes, and owls. Mice not only destroy the products of the farm, but, when they are shut out by well-made granaries, gnaw the trunks and roots of trees, doing much mischief to the orchard. See *Field Mice.* Numerous common traps are contrived for their capture. The carbonate of barytes is recommended in the *Mark Lane Express* as a poison in the place of arsenic; a drachm should be mixed in the food for each mouse, which should also be flavoured with oil of anise seed to attract them. The removal of grain stacks is a good occasion to destroy mice and rats: let the stack be surrounded at four feet by a few stakes, some four feet high; stretch around these either hurdles or a coarse canvass, so that the vermin cannot escape underneath; as the grain is removed, they will attempt to run away, and may be killed by sticks within the enclosure.

MOW. The mass of hay, straw, grain, &c., put up to dry and be preserved.

MOW-BURNED. Injured by fermentation in the mow. Fodder, when too green, heats rapidly, becomes black, and acquires a bituminous taste; this is disagreeable, and sometimes injurious to cattle.

MOWING. The operation of cutting down grass or other crops with a scythe. The instruments used are the common scythe, the cradle-scythe where grain is cut, and the Hainhault scythe and hook, which answers for heavy crops. The operation is extremely fatiguing, and requires great strength and practice from youth, as the body is swung round in a very unusual manner.

MOWING MACHINES. See *Reaping Machines.*

MOXA. A conical mass of calico or linen, rolled tightly, and with a base of half an inch or more; used to produce a sore on the skin in certain diseases. The moxa, being placed on the part selected, is set on fire at the upper part, and, burning slowly downward, acts as an actual cautery. The sore is kept open by being dressed with basilicon, savin, and irritating ointments, and serves as an issue.

MOYA. Mud poured out by volcanoes.

MUCIC ACID. An acid produced by the action of nitric acid on gum and sugar of milk. It is a white, crystalline powder, feebly acid, soluble in six parts boiling water, and insoluble in alcohol. It is bibasic. Formula, $C_{12} H_8 O_{14} + 2 HO$. It was formerly called saccholactic acid. Mucic acid is converted into the pyromucic by dry distillation, $C_{10} H_3 O_5 + HO$. Both these acids form chloro compounds with chlorine.

MUCILAGE. A thick solution of gum in water. The ropy fluids extracted from certain plants by pressure are also called mucilage.

MUCIVORA. A family of dipterous insects, which feed on the juices of plants and decaying matters.

MUCK. A vulgar name for peat, marsh mud, and decaying vegetable matter generally.

MUCOUS MEMBRANE. The

membrane which lines the mouth, nostrils, exterior of the eyes, lungs, stomach, intestines, bladder, and urinary apparatus. It secretes an animal fluid, mucus, by which it is moistened and protected from the contact of air and other substances. Irritations and inflammations are very common, and do not extend so rapidly as in other membranes. They are usually subdued by bleeding, cathartics; or special medicines, when the lungs or urinary membrane is attacked.

MUCRONATE. In botany, a leaf or other organ, having a rounded extremity, tipped with a sharp point or prickle.

MUCUS. The viscid, ropy secretion of the mucous membrane. It contains five per cent. solid matter (albumen), and is azotized.

MUD. The fine particles of earth and organic matters suspended in rivers, &c., and deposited by subsidence. When mellowed by exposure to frost, and composted with one bushel of lime to the cubic yard, it makes a good amendment to loose, thin soils, destitute of humus.

MUD WALLS. See *Cottages*.

MUDAR. *Calotropis gigantea.* An asclepiadeous plant, used medicinally in scrofula in the East.

MUFFLE. A semi-cylindrical vessel of earthen-ware, capable of resisting a high temperature, in which crucibles are placed in assaying, and by which means they are exposed to a great heat without coming in contact with the fuel. The upper, curved side, is usually cut into slits, to allow the passage of reflected heat.

MUGWORT. *Artemisia vulgaris.* A kind of wormwood. It is used in decoction, as a weak stomachic bitter.

MULBERRY. The genus *Morus.* They prefer a moist, deep, loamy soil, and good exposure. The mulberries are readily propagated by layers and cuttings put down in spring. The black fruit (*M. nigra*) mulberry grows to a large size. The fruit is rather sickly, and used as a sirup in medicine. There is a red variety. The wood is yellow, and tolerably hard; it is used in carving and turning. The bark makes strong ropes, when separated by steeping in water and twisted. A common wine is made from mulberries in some parts of Europe. The bark of the root is a vermifuge and cathartic.

The wild mulberry (*Morus rubra*) of the United States yields smaller and pleasant fruit. The *M. tartarica* of the north of Europe yields an insipid fruit, which is, however, preserved, dried, and made into a wine and spirit.

The *M. tinctoria*, or yellow mulberry, yields the fustic of commerce. See *Fustic*.

The white Italian mulberry (*M. alba*) is a small tree of 15 to 20 feet, and extensively cultivated in France and Italy as food for silk-worms. This tree has been much developed and improved. From it the choice Moretta, Provence, and Lombardy mulberries, for silk culture, have been obtained. The multicaulis, Broussa, and Canton, with the hybrid multicaulis, are most suitable for silk culture in the United States, especially the last, which can be cut down to the roots annually, and thus kept perfectly free of frost, for all the mulberries are tender with respect to climate. The Broussa and white yield the earliest foliage, but that of the latter is too small.

The paper mulberry (*Broussonetia papyrifera*) is a tree of some 20 feet, cultivated, in China and Japan, for the paper which is made from the bark of the young shoots. The bark is steeped in water, then boiled, washed, and beaten into a pulp; this pulp, being put into water, separates like grains of meal; to this a mucilage from rice and the root of the manihot is added, to give it consistence; it is then spread, pressed, and dried. The juice of the tree also furnishes a glutinous varnish, used in gilding. The inner bark of the same tree supplies the Otaheitans with a white cloth. The multicaulis and other varieties, treated in the same way, make a coarse paper; the

the pulp is best prepared by steaming.

MULBERRY CALCULUS. A stone of the bladder of the colour and appearance of the mulberry fruit, and consisting of oxalate of lime. It is uncommon.

MULCH. Straw or litter half rotted. Shrubs surrounded with it are said to be mulched.

MULE. "The well-known offspring of the ass and the mare, or of the she ass and the horse. In the latter case, the produce is called a jennet, and is much less hardy, and therefore rarely bred. The term mule is generally applied, in the animal creation, in the same sense with hybrid in the vegetable world, signifying the intermixture of two distinct species. Mules are very hardy animals, and therefore much used in warm climates, where they are preferred to horses, either for the purposes of draught or carriage. No animal is more sure-footed or more hardy; but the pace of the mule is disagreeable to those unaccustomed to its action. The diseases to which the mule is liable are few. He attains double the age of the horse, and is much more easily maintained. The mules of the South of Europe are frequently very fine animals, 16 or 17 hands in height, active, handsome, and peculiarly patient of labour, but very inferior in beauty to the horse, particularly about the head and tail. The importation of Spanish jacks has tended greatly to improve mules, many of which, when bred with care, are sufficiently thickset and heavy for all those purposes in which our largest draught-horses are employed.

"To have large and handsome mules, the mare should be of a large breed, well proportioned, with rather small limbs, a moderate-sized head, and a good forehead; and the ass should be of the large Spanish breed." They are incapable of propagation.

MULING. Hybridizing. See *Hybrid*.

MULLEIN. *Verbascum thapsus*. A common, biennial, large weed, with yellow flowers. They are readily overcome by cultivation, and are usually seen only on neglected fields. There are other species of *Verbascum*, but they are unimportant weeds.

MULLION. The upright post or bar dividing two lights in a window.

MULTIARTICULATE. A term applied, in natural history, to the antennæ, legs, &c., of animals or insects which have many joints.

MULTIFID. Divided into many segments.

MULTILOCULAR. Having many compartments or chambers.

MUMPS. An irritation of the parotid and neighbouring glands, attended with much swelling.

MUNJEET. A kind of madder cultivated in the East.—(*Ure*).

MUREXIDE. A beautiful red product of the decomposition of uric acid by nitric acid. Murexan is formed by dissolving murexide in solution of caustic potass.

MURIACITE. A kind of sulphate of lime, containing common salt.

MURIATES. Salts containing chlorine, more properly called chlorides; muriate of soda is common salt.

MURIATIC ACID, SPIRITS OF SALT, HYDROCHLORIC ACID, MARINE ACID. The substance obtained in commerce is a solution of the true gaseous acid; it is of a yellowish colour from impurities, and at specific gravity 1·15 contains 30 per cent. of real acid: this fluid fumes, possesses a disagreeable smell, and is highly caustic; it decomposes carbonates rapidly, and unites with most mineral oxides. The composition of pure hydrochloric acid is 1 equivalent chlorine with 1 hydrogen; its combining number is, therefore, 36·47: it is procured by distilling common salt with sulphuric acid in an earthen-ware apparatus, and receiving the vapour in water.

Muriatic acid forms soluble compounds with many oxides, and is hence extensively used as a solvent in chemistry; the pure acid should be colourless and yield no precipitate with solution of barytes. The presence of muriatic acid and chlorine is detected by the peculiar curdy precipitate they yield with nitrate of silver, which is soluble while fresh in ammonia, but blackens by exposure to light.

When muriatic acid acts on a metallic oxide, there results a chloride of the metal for the most part, the hydrogen of the acid and oxygen of the oxide forming water.

MURICATE. Thorny. In zoology, a surface armed with short conical eminences, having a sharp apex.

MURIDÆ. A family of rodents, of which the mouse is a type.

MURRAIN. "A contagious, malignant epidemic, which prevails in hot, dry seasons among cattle, carrying off numbers. It once used to sweep off the horned stock of whole districts. It principally appears in marshy and woody districts, or where draining has been neglected, or the cattle have been exposed and half starved. The disease is known by the animals hanging down their heads, which are swollen, by short and hot breathing, cough, palpitation of the heart, staggering, an abundant secretion of viscid matter in the eyes, rattling in the throat, and a slimy tongue. The early stage of murrain is one of fever, and the treatment should correspond with this: bleeding and small doses of purgative medicine will be serviceable. The peculiar fœtid diarrhœa must be met with astringents, mingled also with vegetable tonics. In combating the pustular and gangrenous stage, the chloride of lime will be the best external application; while a little of it, administered with the other medicines inwardly, may possibly lessen the tendency to general decomposition. Above all, the infected animal should be immediately removed from the sound ones."—(*Youatt on Cattle.*)

MUSACEÆ. A small family of tropical plants, resembling the marantaceæ, and including the plantain (*Musa sapientum*) and banana (*M. paradisiaca*), which, together, yield the greater part of the nourishment of tropical America. The leaves are also used for thatch, and the fibres of the stem for cordage. The curious flowering plants called strelitzias are of this family.

MUSCHEL-KALK. Shell limestone, the strata belonging to the new red sandstone series.

MUSCI. See *Mosses.*

MUSCICAPA. A genus of dentirostral passerine birds; they live on insects and small birds.

MUSCIDÆ. A family of dipterous insects, resembling the fly (*musca*).

MUSCLE. Fleshy fibres, susceptible of contraction and relaxation, and by which the phenomena of motion in animals takes place. They are voluntary, or under the influence of the will, and involuntary, as the heart, the muscles of the intestines, &c. They are of a red colour when filled with blood-vessels, but are naturally white, and consist of fibrine, surrounded by cellular tissue, and supplied with nerves, &c.

The lean of meats consists of muscular fibre mostly; it contains about 23 per cent. solid matter, the rest being water. The solid consists of 51·8 carbon, 7·5 hydrogen, 15·0 nitrogen, 21·3 oxygen, with sulphur and phosphorus, and 2·3 ashes per cent. It is one of the most nutritious aliments.

MUSCOVADO. The brown moist sugar as separated from the molasses.

MUSHROOM. A term commonly used to designate the tribe of fungi, toadstools. More correctly, the *Agaricus campestris*, a mushroom with a white smooth cap, with flesh-coloured gills, a pleasant odour, growing in fertile meadows during the autumnal months, and collected as a delicacy, and for the manufacture of catsup. Mushrooms are propagated from spawn, which is kept by the seedsmen, or it may be collected in the fall in those places where the plants abound: it resembles pieces of thread, and is imbedded in earth or dung. When kept quite dry, the spawn will retain its germinating power for three or four years. The following is chiefly from Loudon and Bridgeman:

"A mushroom bed is simply a heap of animal dung and earth, so tempered as to be capable of producing and preserving spawn; but, in order to have fruitful spawn at all times, it should be so formed as to be always at command. To this end, a quantity of fresh horse droppings, mixed with short litter, should be collected; add to this one third of cow dung, and a small portion of good earth, to cement it together; mash the whole into a thin compost, like grafting clay; then form it in the shape of bricks, which being done, set them on edge, and frequently turn them until half dry; then, with a dibble, make one or two holes in each brick, and insert in each hole a piece of spawn the size of an egg: the bricks should then be laid where they can dry gradually. When dry, lay dry horse dung on a level floor, six or eight inches thick; on this pile the bricks, the spawn side uppermost. When the pile is snugly formed, cover it with a small portion of fresh warm horse dung, sufficient in quantity to produce a gentle glow through the whole. When the spawn has spread itself through every part of the bricks the process is ended, and they may be laid up in any dry place for use. Mushroom spawn, made according to this receipt, will preserve its vegetating powers for many years, if well dried before it is laid up; if moist, it will grow, and soon exhaust itself.

"Mushroom beds are often formed in ridges in the open air, and covered with litter and mats, so as to prevent heavy rains exciting fermentation; and sometimes in ridges of the same sort under cover, as in the open sheds of hot-houses. They are also made in close sheds behind hot-houses, or in houses built on purpose, called mushroom-houses. A moderately warm, light cellar is peculiarly suited for the purpose in the winter season, as no fire is necessary, and but little water, the application of which frequently proves injurious, when not judiciously managed. Mushrooms may also be raised in pots, boxes, hampers, &c., placed in warm situations, in old beds, in pits with glazed frames, and in dark frames or pits.

"The general way of making mushroom beds is to prepare a body of stable dung, moderately fermented, about a yard in thickness, more or less, according to the size and situation in which the bed is to be formed; when the strong heat has subsided, an inch of good mould may be laid over it, and the spawn planted therein in rows five or six inches apart; after this is done, another layer of mould, an inch thick, may be added, and then a coat of straw. Beds well constructed will produce mushrooms in five or six weeks, and will continue to produce for several months, if care be taken in gathering not to destroy the young ones. As mushrooms are gathered, from time to time, the straw should be spread carefully over the bed.

"Beds made in a convenient place, where there is space all around, may be formed so as to make four sloping surfaces, similar to the roof of a house; this, by being spawned on the four sides, will yield abundantly. The celebrated Mr. Nichol makes his beds without spawn.

"After having laid a floor of ashes, stones, chips, gravel, or brickbats, so as to keep the bed quite dry and free from under damp, lay a course of horse droppings, six inches thick. These should be new from the stables, and must not be broken, and the drier the better. They may be collected every day until the whole floor or sole be covered to the above thickness; but they must not be allowed to ferment or heat. In the whole process of making up, the bed should be as much exposed to the air as possible; and it should be carefully defended from wet if out of doors. When this course is quite dry, and judged to be past a state of fermentation, cover it to the thickness of two inches with light, dry earth; if sandy, so much the better. It is immaterial whether it be rich or not, the only use of earth here being for spawn to run and mass in. Now lay another course of droppings, and earth them over as above, when past a state of fermentation: then a third course, which, in like manner, earth all over. This finishes the bed, which will be a very strong and productive one if properly managed afterward.

"Observe that, in forming the bed, it should be a little rounded, in order that the centre may not be more wet or moist than the sides. This may be done in forming the sole or floor at first, and the bed would then be of equal strength in all parts. If it be made up against a wall in a cellar, stable, or shed, it may have a slope of a few inches from the back to the front, less or more, according to its breadth. I have sometimes been contented with two courses, as above, instead of three; and often, when materials were scarce, have made them up slighter, thus: three four-inch courses of droppings, with one inch of earth between each, and a two-inch covering at top. Such a bed as this I have had produce for ten or twelve months together; but very much depends on the state of the materials, on the care taken in making it up, and also on the after management.

"The droppings of hard-fed horses only are useful. Those of horses kept on green food will, of themselves, produce few or no mushrooms. I have made up beds from farm horses, fed partly on hard and partly on green food, and from carriage or saddle horses, fed entirely on corn and hay; treated them in the same way in every respect, and have found, not once, but always, those made from the latter most productive. Droppings from hard-fed horses may be procured at the public stables in towns, or at inns in the country, any time of the year; and if the supply be plentiful, a bed of considerable dimensions may be made and finished within five or six weeks. In as many more weeks, if in a stable or dry cellar, or a flued shed, it will begin to produce, and often sooner; but if the situation of the bed be cold, it will sometimes be two or three months in producing mushrooms.

"It may be necessary to state, farther, that extremes of heat, cold, drought, and moisture should be avoided in the cultivation of mushrooms. If the temperature keeps up to 50° in the winter, the beds will be safe, and the heat in the beds may rise to 60°, or even 70°, without injury. Air, also, must be admitted in proportion to the heat, and 60° should be aimed at as a medium temperature. Water, when given a little at a time, is better than too much at once, after the spawn has begun to spread, and the water for this purpose should always be made blood-warm. A light covering of straw may be used to preserve moisture on the surface; and if the beds are made in open frames, or otherwise subject to exposure, the straw may be laid thicker than on beds made in a cellar.

"Should beds fail in producing mushrooms after having been kept over hot or wet, it may be inferred that the spawn is injured or destroyed; but if, on the contrary, a bed that has been kept moderately warm and dry should happen to be unproductive, such bed may be well replenished with warm water, and a coat of warm dung may be laid over the whole. If this does not enliven the bed after having lain a month, take off the earth, and if, on examination, there is no appearance of spawn, the whole may be destroyed; but if, on the contrary, the bed should contain spawn, it may be renovated by covering it again, especially if any small tubercles be discernible; if the heat should have declined, the spawn may be taken out and used in a fresh bed. If beds be formed in hot-bed frames under glass, some mats or straw must be laid over the glass to break off the intense heat of the sun."

If any accidents arise from eating improper mushrooms, vomiting, by means of a mixture of salt and water, should be encouraged.

MUSKMELON. The common yellow melons, of little flavour, and unworthy of cultivation. See *Melon.*

MUSQUITO, MOSQUITO. Insects of the genus *Culex*, armed with a sharp proboscis, by which they pierce the skin. They abound in damp places.

MUST. The fresh juice of the grape before fermentation. Other juices capable of fermentation.

MUSTARD. Two species are cul-

tivated, both annuals; the *Sinapis alba* (*a*), for salad, oil, as an ingredient in pickles and medicine; and *S. nigra* (*b*), or black mustard, for the condiment known by that name. For salad, the seeds are sown very thick in rows of two or three inches wide, and the crop cut while in the second leaf. It grows up in a few days, and may be sown any time during the season, if well watered and sheltered from the hot sun.

For a field crop the soil should be fine, rich, and loamy, deeply ploughed, rather moist and light than otherwise. The seed is sown thinly, broadcast, in April or May: two to three gallons are used per acre. The plants are hoed in the fourth leaf, and, to keep down weeds, thinned to eight or twelve inches apart, and collected as soon as the pods have changed from green. It may be sown in drills two feet apart, and twelve inches in the row. It must be well dried before thrashing, which is done by a flail. It ought not to be exposed to rains. A good crop is twenty-four to thirty-two bushels per acre, which will bring from $70 to $100, at eight cents the pound for seed. In the manufacture of mustard the white and black seeds are combined, although the black is best; they are pressed between rollers, and ground in a mill set apart for the purpose, and sifted and screened as fine flour. The pungency of mustard, by which it raises blisters on the skin, is due to a volatile oil containing sulphur, which is not originally present in the flour, but results from the action of the moistened emulsin (*myrosyne*) of the seeds upon a peculiar acid present, to which the name of myronic acid has been given. The secret of making good flour, therefore, consists of keeping the whole perfectly dry from the seeds to the time of sale, otherwise the changes which produce the active principle will have taken place before it is wanted. Vinegar diminishes this change, and should not be used with mustard: tepid water is the proper fluid to mix up the condiment, or make the irritating poultice. The seeds of many cruciferous plants are occasionally substituted for the true mustard.

The white mustard yields a bland oil in large quantity, from twenty-five to thirty per cent. by expression. The cake is employed as a good manure. The black species is also sown in borders around seed beds, to protect them from the black flies (*haltica*).

MUSTELLA. The genus containing the weasel and other vermin quadrupeds.

MUTAGE. A process to stop the fermentation of must. It is practised either by diffusing sulphurous acid in the cask into which the liquor is racked by burning sulphur matches, or by adding a little sulphite of lime to the must: the latter is the best.

MUTICUS. Beardless, without awns, or *aristæ*.

MUTTON. The flesh of the sheep. The best meat is that from wethers three to five years old, of the South Down or improved Leicester breed. The spayed ewe five years old is also said to make equally good meat. The offal of a well-made animal with fine bone should not exceed one third of the live weight.

MUZZLE. The nose of an animal. A kind of halter fastened over the nose to prevent an animal from biting. Muzzle of a plough is the end of the beam to which the clevis is attached.

MYCELLA. The young, flocculent filaments of fungi.

MYOLOGY (from *μυων, a muscle*, and *λογος, a discourse*). An account of the muscles of the body.

MYOPS. Shortsightedness.

MYRIAMETER. Ten thousand metres, equal to two leagues.

MYRICIN. That portion of wax which is insoluble in alcohol.

MYRISTICACEÆ. A family of tropical trees, exogens, containing the nutmeg. They are nearly allied to the *laurels*.

MYRONIC ACID, MYRONATES. An acid existing in cruciferous seeds, and containing sulphur.

MYROBALANS. A bitter, austere fruit, used in India in calico dyeing and medicine.

MYROSYNE. A substance resembling emulsin, or caseum, in mustard seeds.

MYRRH. An odoriferous gum resin imported from the East, and supposed to be the product of a species of *Amyris*. Sweet cicely is sometimes called by this name.

MYRTACEÆ. A family of small trees and shrubs, particularly developed in tropical climates, and yielding the pimento, cloves, guava, cajeput, and other aromatic products.

MYRTLE. *Myrtus communis.* An evergreen, fragrant bush with white flowers. It is a Southern plant, and requires protection from frosts.

MYRTLE BILBERRY. The whortleberry.

MYRTLE, DUTCH, or SWEET GALE. *Myrica gale.* A sweet-scented, swamp shrub, three or four feet high, bearing waxy berries.

N.

NACREOUS. Reflecting iridescent light, like pearl.

NACRITE. A pearly mineral. Silicate of alumina and potash

NÆVUS. A natural mark or blotch on the skin.

NAG. A small horse.

NAILS. The horny extremities of the skin, modified into claws, talons, hoofs, &c. They are of the same composition as hair, and yield an equally valuable manure. 100 lbs., during decomposition, yield 20 lbs. of ammonia. They are best in composts, at the rate of 300 to 400 lbs. to the acre, and show their effects for several years. The composition of horn gives that of nails, hoofs, &c., 52 carbon, 6·7 hydrogen, 17·3 nitrogen, 24 oxygen and sulphur, with less than one per cent. ashes, in 100 parts. All these textures are used in the manufacture of glue.

NAKED. In botany, without the customary covering, as a stem without leaves, corolla without calyx, &c.

NAKED DISEASE, PELT ROT, HUNGER ROT. A disease of sheep poorly kept, in which the wool, and sometimes the horns and hoofs, drop off. It is to be remedied, if taken in time, by shelter and good food in sufficient quantity.

NAKED FLOORING. The timber-work of the floor.

NANKIN, NANKEEN. A buff colour. Calico may be dyed of this colour by the following means: Take 300 lbs. of yarn, scour and boil in pure water, wince the hanks in an alum bath containing 2 lbs. of alum to 96 gallons of water at 165° Fahr.; drain, expose to the air, rinse in pure water, and wring. Boil 40 lbs. of oak bark, contained in a canvass bag, for two hours, in 100 gallons of water; wince the cotton through the boiling bath a quarter of an hour; while it is draining above the bath, add 28 ounces of alum; and, when it is dissolved, wince through again for a quarter of an hour; drain, wring, and expose to the air. It is now of a yellowish colour. Make a clear limewater bath of about 150 gallons, or a weak soda lye; dip the hanks, without washing, into it rapidly three times; then move each hank separately in the bath until it is of the proper colour; squeeze, rinse, and air them, and, finally, brighten by passing them through a weak solution of tin.

NAPHTHA. A highly-inflammable fluid, of a peculiar odour, sp. gr. 0·75, which exudes from the earth in some places. A similar fluid is distilled from wood tar, and called wood naphtha. It is used as a solvent of India rubber.

NAPHTHALINE. A white, crystalline, volatile product of the destructive distillation of pit coal. Naphthalic acid, naphthalamide, &c., are derivatives.

NAPIFORM. Turnip-shaped.

NARCEIA. A vegetable alkaloid from opium, producing salts of a blue colour. Little is known concerning its effects.

NARCISSUS. Ornamental bulbous flowers.

NARCOTICS. Anodynes. Drugs which produce sleep, drowsiness, and allay pain. Opium, henbane, tobacco, camphor, stramonium, &c., are of this kind.

NARCOTINE. A vegetable alkaloid existing in opium, to which its stimulating effects is due.

NARES. The nostrils.

NASCENT. In the act of being produced or evolved. A chemical phrase given to the evolution of gases from fluids, at which time they are more fitted to unite with other bodies. Hydrogen, nitrogen, and other gases, in the aëriform state, combine only slowly with substances, but when nascent enter readily into union.

NASTURTIUM. *Cress, Indian.*

NASUTA (from *nasus, the nose*). A prolongation of the muzzle into the form of a nose.

NATANS, NATANT, NAYANT. Floating or swimming.

NATATORY. In zoology, when the feet or tail are provided with a membrane or hairs to repel or displace water, and buoy up the insect or animal.

NATRIUM. Sodium. See *Soda.*

NATROLITE. A fibrous, yellowish mineral. Silicate of alumina and soda.

NATRON. Soda. Impure, native sesquicarbonate of soda, found in Egypt, Fezzan, Tartary, Hindostan, in Mexico near Zacatecas, and in Columbia forty-eight miles from Merida. That of Fezzan is called *Trona*, and the Columbian *Urao*. All these localities are either in lakes or on the sites of ancient lakes. Egyptian natron consists of 22·44 carbonate of soda, 18·35 sulphate of soda, 38.64 common salt, 6·0 insoluble matter, and 14·0 water: trona, of 65·75 carbonate, 7·65 sulphate, 2·63 salt, 24 water, 1 insoluble matter.

NATURAL HISTORY. A description of natural objects, as animals, plants, insects, fishes, minerals, fossils.

NATURAL ORDERS OF PLANTS. *Natural system of Jussieu.* Groups of plants having a close similarity in internal organization, and frequently in external characters and properties.

NATURAL PHILOSOPHY. Physics, mechanical philosophy. The science which investigates the mechanical laws of nature; and the relations of weight, movement, pressure, or of mechanical forces in masses.

NAUCA. A seed in which the scar of the hilum occupies a third of the surface.

NAUSEA. A feeling similar to that preceding the act of vomiting.

NAVE OF A WHEEL. The hub, the block in the centre of the spokes, which receives them. It is bound by two *nave-bands* of iron on the outside, and contains in the inside an iron box or washer, to save the friction of the axle.

NAVEL ILL See *Calf.*

NAVEL-WORT. The American plant is *Hydrocotyle umbellata,* and a water weed.

NAVEW. *Brassica campestris.* The wild plant is a native of England: in the cultivated form it is known as colza and rape.

NAVICULAR (from *navis, a ship*). Having the figure of a ship's body. It is applied to the nut bone of the foot, as well as to the form of seeds, &c.

NEAT CATTLE. Horned cattle, oxen.

NEAT'S-FOOT OIL. The fat obtained by boiling calve's feet.

NEBULA. A cluster of small stars appearing like a minute cloud.

NECK, COLLUM. In plants, the space between the stem and roots, often swollen in size. The *neck of a capital* is the space above the shaft between the ring (*annulet*) above, and the astragal at the top of the shaft.

NECROPHAGANS, NECROPHAGA (from νεκρος, *dead*, and φαγω, *I eat*). A family of clavicorn beetles, some of which live on decomposing animal matters.

NECROSIS (from νεκροειν, *to destroy*). A disease, resembling mortification, of the bony structures. In plants, the term means the rotting of the part.

NECTARY, NECTARIUM. The part of a flower which secretes honey. It is usually an appendage of the petals or disk.

NECTARINE. The smooth peach. See *Peach*.

NEGATIVE SIGN. Minus, or —. It is employed to denote quantities or measures below a standard.

NELUMBIUM. A marsh plant of China, the seeds of which, of the size of an acorn, are eaten green, or preserved as sweatmeats, and have a nutty flavour. The succulent roots are also eaten raw as a fruit, or boiled as a vegetable.

NEMOCERA. A family of diptera, with filiform antennæ.

NEMOGLOSSATA. The bee tribe, and those hymenoptera which have a long, thread-like tongue.

NEMOROSE, NEMOROSA. Belonging to the woods.

NEP. Catmint.

NEPHRITE. A tough, greenish mineral, used to manufacture ornaments. A silicate of alumina and magnesia with iron.

NEPHRITES (from νεφρος). Inflammation of the kidney. Bleeding, warm baths, purges, diluents are used.

NEPTUANIAN THEORY. The theory of Werner, that geological formations were due to aqueous causes.

NERIUM. A genus of important Eastern plants. *N. antidysentericum* affords the codaga bark; *N. tinctorium*, a beautiful evergreen of India, affords some indigo from its leaves.

NEROLI, OIL OF. The distilled essential oils of orange flowers.

NERVES. The white, thread-like fibres which, proceeding from the brain or spinal marrow, ramify throughout every part of the bodies of the higher animals. They convey impressions from and to the brain, preside over the functions of the different organs, and regulate motion and the senses. Nerves can hardly be said to be absent in any animals, although they become extremely rudimentary in many. Chemically, nervous matter consists of seven parts albumen, five fatty matter, and eighty water. The fat is peculiar, containing phosphorus.

Most diseases affecting the whole body are accompanied, or commence in an impaired state of the nervous system, which presides over health. Nerves are said to be *cerebral* when they proceed directly from the brain: there are nine pairs of these, and they preside over the senses. The nerves arising from the spinal marrow are termed *spinal nerves*, and divided into cervical, dorsal, lumbar, and sacral. They preside over motion and ordinary sensation, as well as the functions of the lungs, stomach, liver, and other viscera. The *great sympathetic* nerve is a series of junctions between the spinal nerves, and is connected with the brain; in its course, small masses of a reddish colour occur, called ganglions: it renders the functions of the different organs uniform. A *plexus* of nerves is a net-work formed by the union of various filaments.

NERVES, or NERVURES. In plants, the ramifications of woody tissue and vessels seen upon leaves, flowers, &c. They support the cellular tissue of the leaves.

NETHERLANDS, HUSBANDRY OF. See *Flanders*.

NETTED. Reticulated, marked like the meshes of a net.

NETTLE. The genus *Urtica*, herbaceous and shrubby plants, often furnished with stinging hairs: their burning is lessened by vinegar and oil. A rennet is made by adding salt to a strong decoction of nettles. Asses eat the common nettle, and sometimes the boiled sprouts are used as vegetables. The commonest stinging species are *U. dioica, urens, Canadensis*, and *procera*. The common nettle (*dioica*) is a troublesome perennial weed in cultivated lands, and requires to be ploughed out by tillage. The *U. nivea* and *cannabina* yield fine hemp. The *U. Canadensis*, Canada or Albany nettle, grows six feet high, is indigenous, perennial, and has been recommended as a hemp plant. It is, however, covered with stings.

NETTLE-TREE. The genus *Celtis*, amentaceous trees. The principal American species is the *C. occidentalis*, the sugar or pompion berry. It is seldom twenty feet in the Middle States, but becomes seventy on the Savannah. It is ornamental, with small, white flowers, and sweet, reddish fruit.

NETS. They are useful in the orchard and garden to protect seed and fruit from birds.

NEURALGIA. Pain of the nerves.

NEURILEMA. The covering of the nerves.

NEUROPTERA. Insects with four netted wings. See *Insects*.

NEUTERS. Infertile animals or plants, having neither stamens nor pistils.

NEUTRAL, NEUTRALIZATION, NEUTRALIZED. The combination of an acid with an alkali, or of two active bodies together, by which the properties of either are perfectly destroyed. The addition must be made in the proportion of their equivalents to produce neutral compounds.

NEUTRAL SALTS. Salts which betray neither an acid nor alkaline reaction.

NEWEL. In building, the space around which a flight of steps is turned.

NEW-JERSEY TEA. *Ceanothus Americana*. A common marsh shrub with fragrant bunches of flowers. It was used in the Revolution for tea.

NEW HUSBANDRY. The drill and horse-hoe husbandry.

NEW RED SANDSTONE. The series of strata lying immediately above the coal formation. It consists of conglomerates, and contains marl, gypsum, and large quantities of rock salt. It is found abundantly in New-York, the Valley of Virginia, and of the Connecticut.

NEW ZEALAND FLAX. *Phormium tenax*. Iris-leaved flax lily. It grows with broad, stiff leaves, like those of lilies, the fibres of which are readily obtained by rotting. They are of extraordinary strength, and used for fishing-lines, cordage, and coarse cloth. It requires a warm climate for successful cultivation.

NICARAGUA WOOD. The dyewood of the *Cæsalpina echinata*, a tree of South America. The red colour is fugitive with solution of tin.

NICHE. A recess in a wall for a statue.

NICKEL. A rare white metal, like iron. Its salts are green for the most part. It exists in meteoric stones.

NICKING AND DOCKING. Pricking. Cutting off part of a horse's tail, and making nicks on the under side, to divide the two cords which draw down the tail; this causes the stump to stand out in what a stable-boy supposes a graceful fashion. It is nearly obsolete.

NICOTIN, NICOTINA. An acrid, soluble, volatile alkaloid found in tobacco. It combines with acids, and forms salts. It is very poisonous.

NICOTIANIN. A fatty, volatile, azotized body, insoluble in water, formed during the fermentation of tobacco in preparing for the market, and to which its odour is due. It is poisonous, especially to insects and reptiles.

NICTITATION. Winking. The movement of the membrane covering the eyes of birds and some animals, called the *membrana nictitans*.

NIDUS. A nest. A suitable position or matrix for development. *Nidulus* and *nidulate* are derivatives.

NIGER. Black. *Nigrescent*, growing black. *Nigricans*, blackish, sooty.

NIGHTSHADES. The genus *Solanum*. They are mostly perennial or shrubby, of the family *Solanaceæ*, the fruit and leaves being often poisonous, especially in the *S. nigrum* and *dulcamara*, or bittersweet. They are common weeds in moist, cultivated grounds. The deadly nightshade is the *Atropa belladonna*. The potato, egg fruit, and tomato are of this genus.

NIGHT SOIL. The contents of privies. It is a very valuable manure for all crops. In the fresh state it is applied at the rate of six to twelve cart loads the acre; but this is an unpleasant and wasteful application. It may be dried, and rendered inodorous by union with charcoal, charred peat or broken peat, coal ashes or fine mould, and drying by exposure to the air. This forms one kind of poudrette. It is best treated with charcoal powder, gypsum, or very small quantities of green vitriol, the sulphuric acid of which fixes the volatile ammonia. Quicklime and unleached ashes are objectionable additions, as they liberate the ammonia and cause loss. The most economical method, so far as the soil of the farm is concerned, is to keep pounded charcoal and a little gypsum in the cess pool, so as to have it ready for use as soon as removed. Drying night soil in the air, without any addition, is wasteful; for fermentation comes on rapidly, and great loss of ammoniacal matters arises. For the Flemish method of using night soil, see *Flanders Husbandry*.

Night soil is a mixture of urine and fæces, and, as such, must vary in composition, and has never been examined. The fæces and urine separately were analyzed by Berzelius, who found the composition of the fæces to be as follows:

Remains of food	7·0
Bile	0·9
Albumen	0·9
A peculiar extractive matter	2·7
Indeterminate animal matter, viscous matter, resin, and an insoluble residuum	14·0
Salts	1·2
Water	73·3
	100·0

The salts had the following composition:

Carbonate of soda	29·4
Chloride of sodium	23·5
Sulphate of soda	11·8
Ammoniaco-magnesian phosphate	11·8
Phosphate of lime	23·5
	100·0

Human urine is one of the most powerful of all manures. Left to itself, it speedily undergoes putrefaction, and evolves an abundance of ammoniacal salts. Its composition is:

Urea	3·01
Uric acid	0·10
Indeterminate animal matter; Lactic acid, and lactate of ammonia	1·71
Mucus of the bladder	0·03
Sulphate of potash	0·37
Sulphate of soda	0·32
Phosphate of soda	0·29
Chloride of sodium	0·45
Phosphate of ammonia	0·17
Chlorohydrate of ammonia	0·15
Phosphate of lime and of magnesia	0·10
Silica	traces
Water	93·30
	100·00

The phosphates of lime and magnesia which it contains are extremely insoluble salts, and have been supposed to be held in solution by phosphoric acid, lactic acid, and very recently, by Professor Liebig, by hippuric acid, which he now states to be a regular constituent of healthy human urine.

From the interesting inquiries upon urine made by M. Lecanu, it appears that a man passes nearly half an ounce of azote with his urine in the course of 24 hours. A quantity of urine taken from a public urine pail of Paris yielded 7 per 1000 of azote. The dry extract of the same urine yielded nearly 17 per cent.

It is difficult to give an estimate of the comparative value of night soil, for the urine present is nearly altogether the valuable part, and the amount varies. It is, however, more active (hotter) and valuable than the best horse dung, being estimated at 14, and horse dung at 10. A. Young increased his crop of wheat, on a poor gravel, from 12 to 31 bushels by 160 bushels, upward of six bushels more than he obtained by 60 cubic yards of farm-yard manure. According to Boussingault, when dried in the air it is 10 times as fertilizing as good farm-yard manure. It may be composted with any of the ordinary manures, and should be ploughed under shallow, and near to seed time. As a poudrette, it is used to the hill, or as a top-dressing. It is best applied to quick-growing, rank plants, as turnips, and cruciferous plants generally, Indian corn, potatoes, &c.

NIMBUS. The rain cloud. It is black, and near the earth.

NIPPERS. The four front teeth of the horse. They are put forth between the second and third years. Pincers, forceps.

NIPPLE. A conical elevation. The extremities of the udder. Teats.

NITIDUS. Shining, polished, smooth.

NITRATE OF AMMONIA. This has been used as a steep, in the same way as nitre, but is, perhaps, too expensive, except for garden crops. Nitrate of lime, for leguminous crops, and perhaps all others, would probably be as serviceable, and much cheaper.

NITRATE OF SILVER. In the fused state, called lunar caustic, and much used as a caustic. It consists of one equivalent of nitric acid united with one of oxide of silver. A solution is used in the laboratory to detect the presence of muriatic acid and chlorine in solutions, with both which it forms a white, curdy precipitate. It is also a test for organized matter, becoming black in its presence.

NITRATES. Salts containing nitric acid combined with a base, as nitrate of potash, soda, lime, ammonia.

NITRE. Saltpetre, nitrate of potash. A compound of 54 parts (1 equivalent) of nitric acid with one equivalent, or 48 parts potash. It crystallizes in six-sided prisms, with two faces at the summits; is soluble in seven parts cold, and less than its weight of hot water. It is for the most part derived from the soil of India, Egypt, and Spain, and exists in most limestone caverns and about dunghills. The crude nitre contains nitrate of lime chiefly, but by adding fresh ashes, boiling, and crystallizing, nitrate of potash is obtained. It is extensively used in the manufacture of gunpowder, preserving meats, and as a chemical and medical compound. The coarser kinds have also been used, to a great extent, in agriculture, principally as a steep for corn, wheat, and grain generally. For this purpose, one pound, dissolved in one gallon and a half of water, answers for a bushel of grain. This is the strength used by Mr. Campbell, but ordinarily five or more gallons of water are employed. The grains remain for 60 hours. This steep not only forwards their germination and start, but is one of the best preservatives against rust, smut, and insects. The pounded nitre has been used at the rate of from 50 to 100 lbs. to the acre as a top-dressing to grass, wheat, barley, and other crops. It frequently does great good, especially on poor, sandy soils, but is not so apparent on very rich lands, and sometimes fails altogether. The high price of $7 to $9 the cwt. forbids its use except as a steep; which seems, also, to be the most effective application. Nitre and nitrates are by no means uncommon in plants. It has been found in the sunflower, borage, barley, tobacco, Indian corn, beet root, and probably exists in all grain plants. It does not seem to have any remarkable advantage over the nitrate of soda, or cubic nitre of Peru, which is one half the price.

NITRE, CUBIC. Nitrate of soda. It consists of one equivalent nitric acid and one soda; is crystallized in rhomboids; is very soluble and deliquescent, requiring but three parts water, at 60° Fahr., for solution. It has been used to land precisely as nitre, with similar effects. The great part of the salt in commerce is derived from Peru, where immense deposites of it occur in Taracapa and Atacama.

NITRIC ACID. Aquafortis. The pure acid is unknown, that of the shops being a solution in water; the strongest specimens have a sp. gr. of

1·5, and contain one atom of acid (54), with two of water; it is of a yellowish tinge, smokes, and is extremely caustic, dissolving most metals. The pure acid consists of one atom of nitrogen with five of oxygen (formula, $N\ O_5$). The commercial specimens are adulterated with oil of vitriol and muriatic acid, which are detected by the occurrence of a precipitate when nitrate of silver or limewater is added: this does not occur in pure acid. Nitric acid is extensively employed in the laboratory as a solvent, and, from its active action on many compounds, it readily parts with a portion of its oxygen, oxydizing organic and other bodies presented to it. Its salts are soluble in water, and decrepitate on a hot coal.

NITRIC OXIDE, NITROUS GAS. Binoxide of nitrogen. This gas is given off when dilute nitric acid acts on a metal; it turns red in the air, being changed into nitrous acid.

NITRIFICATION, NITRE BEDS. Nitrates of lime or magnesia are often artificially formed, and the compound subsequently converted into nitre by boiling with wood ashes, &c. The production of nitrate of lime in agriculture, to be applied to the field and form steeps, is worthy of attention; this is readily effected by mixing animal and vegetable rubbish with air-slacked lime in loose heaps of any desired length, and six feet wide by three feet high; these should be arranged under a shed, to protect them from rain and heat, and kept moist with urine, blood, ditch water, and animal or putrescent fluids; the heaps should be built on tempered, dry ground that will not absorb fluid, and occasionally spaded over. In from four months to one year, according to the heat and abundance of animal matter, the heaps will be rich enough for use as a top-dressing, or may be washed, to separate the nitrate: as much of the nitre-bed substance as contains 100 pounds of nitrate may be used as a top-dressing to the crop, or put into compost with other fertilizers. As soon as one bed is removed another should be erected, and thus a succession formed, in which every kind of offensive garbage, night soil, and every kind of animal texture will be consumed with profit to the farmer, and one of the most active manures for poor soils created. Peat, fine mould, river mud, and such substances may be used to mix with the nitre bed when a basis is wanted.

The rich mould of the forest, old manure heaps, damp calcareous tracts of land are all natural nitre beds, which may be put up without any organic matter, but in which, the more we add, the more rapidly nitrates are formed.

NITRITES. Salts of nitrous acid. They are not of agricultural importance.

NITROGEN. Azote. An elementary gas, colourless, inodorous, inactive, of nearly the same weight as air, incapable of sustaining life or flame, forming 8-10ths of the atmosphere, and existing in nitric acid, ammonia, cyanogen, and numerous compounds. It is abundantly present in animal textures, and forms a minute part of all plants, rarely attaining 5 per cent. Its equivalent is 14·2, symbol N. Its compounds with oxygen are numerous; of these, nitric acid is the most important; nitric oxide, or the binoxide, seems to be a compound radical. With hydrogen it forms ammonia, a substance of great importance, of which we shall treat here.

Ammonia (*volatile alkali*), in the pure state, is a very pungent, inflammable gas, consisting of one equivalent of nitrogen (14·2) and three of hydrogen (3), and having a combining number of 17·3: symbol $N\ H_3$. Water dissolves 700 to 800 times its volume of the gas; the solution, or liq. ammonia, of sp. gr. ·87, contains 32 per cent. ammonia: it becomes caustic, pungent, and alkaline. It is the usual form in which this body is known. It readily unites with acids, forming salts of ammonia, of which the sesquicarbonate, or sal volatile, preserves the odour.

Ammonia is one of the products of fermenting animal matter, and its smell may be detected in cess-pools and dunghills; the carbonate and muriate usually formed are volatile, and escape into the air; hence it is recommended that charcoal be used to absorb these substances, or that sulphuric acid, gypsum, or green vitriol (sulphate of iron) be employed to convert them into sulphates, which are not volatile at ordinary temperatures. Liebig asserts that an appreciable amount of ammonia exists in the air and rain storms, derived from decompositions occurring on the earth. Much of the fertility of decaying putrescent matters is said to depend on the evolution of ammoniacal compounds, or the nitrates which they originate by farther decay.

In the compounds of ammonia with bases, it becomes converted—according to modern authorities—into an oxide of ammonium, or $N\ H_4\ O$, or an hydrate of ammonia; hence, a nitrate of ammonia is, according to this nomenclature, a nitrate of the oxide of ammonium, $N\ H_4 O + N\ O_5$. The nitrate, sulphate, muriate, and numerous organic salts of ammonia, have been found in plants. The sulphate, carbonate, muriate, and nitrate have been used as steeps in the same way and dose as nitre, but are too expensive in the commercial form; most of these are found in stable manure and putrescent composts. The amount of ammonia taken by a crop from an acre rarely exceeds 30 pounds, except in such crops as turnips, cabbages, and cruciferous plants, which often carry off upward of 100 pounds. Some plants evolve ammonia from their leaves, and all throw off nitrogen, which is most probably derived from ammonia taken from the soil. The common salts of this alkali are all soluble, and decomposed or volatilized at a red heat.

NITRO. A prefix to the name of bodies containing nitric acid or nitrogen.

NITRO-MURIATIC ACID. *Aqua regia.* A mixture of strong nitric and muriatic acid, whereby chlorine is evolved, which dissolves gold, platinum, and other metals.

NITROUS ACID. A pungent, orange-coloured, volatile acid, consisting of one equivalent nitrogen and four oxygen.

NITROUS OXIDE. Protoxide of nitrogen, laughing gas.

NOCTURNAL. Of the night. Many birds and insects prey only at night.

NODE. A knot or lump. A bony tumour. The swelling on the stems of plants where leaves start; also called nodi. A *nodal point*, in physics, is a place of rest, where several forces counterbalance one another.

NODOSUS. Knotty.

NODULE. Rounded, irregular lumps or masses.

NOGGING. In building, brick-work carried up between uprights of timber scantling.

NOMENCLATURE. The language employed in scientific descriptions.

NON-CONDUCTOR. A substance incapable of conducting heat or electricity.

NONESUCH. The black medic (*M. lupulina*), common in upland meadows.

NOOTH'S APPARATUS. A series of three glass vessels, placed vertically, for the purpose of impregnating water with carbonic acid gas. The lower vessel contains the marble and muriatic acid for the evolution of the gas; the central vessel holds the water, through which it is made to pass, under the pressure of the column of water in the third or upper vessel, which is closed by a conical stopper, which serves as a safety-valve.

NOPAL. The *Opuntia cochinillifera*, a cactus on which the cochineal insect lives: native of the sandy tracts of Mexico.

NORDHAUSEN SULPHURIC ACID. Fuming strong acid obtained by the distillation of green vitriol.

NORMAL. Regular, straight, usual.

NOSE-BAG. A bag containing corn or oats to be tied to the horse's nose.

NOSE-BAND. That part of the headstall of a bridle which comes over a horse's nose. It is sometimes termed maserole.

NOSOLOGY. A classification or dissertation on diseases.

NOTCHED. Crenate.

NOTCH-BOARD. In building, the board which receives the ends of the steps of a staircase.

NOTHUS. Spurious.

NOVACULITE. Hone stone.

NOVEMBER. In this month the later or fall crops, as carrots, turnips, cabbages, &c., are collected, and stored up from frost; preparation is to be made for securing the fodder in a suitable place for stock; the farmstead is to be set right for wintering. All stiff lands are now ploughed for spring crops. The latter steps of curing tobacco, the preparation for rotting hemp, and securing cotton for market, are now made. In the garden, early vegetables are to be looked after, and frames got ready to protect them from winter. The land may be trenched for spring crops; transplanting can take place until the ground begins to freeze too deep.

NUCLEUS. The point around which crystals or organized structures are developed: the origin. In botany, the upper, pulpy mass of an ovule; the interior of a seed. The shield of lichens.

NUCULA. A fruit like the acorn, or a one-seeded, hard seed-vessel.

NUDUS. Naked.

NURSERY. "In gardening, a plot of ground, or an entire garden, set apart for the propagation of plants, more particularly trees and shrubs. The situation ought to be open and airy, and the soil of an average quality, neither too heavy nor too light, so as to be adapted to the majority of plants; but in a complete nursery there ought also to be shady borders for plants requiring shade, and beds or compartments of peat soil, or other peculiar soils, for such plants as are not readily propagated and grown in ordinary soils. Where tender plants are propagated, or where hardy plants are to be raised from seeds, or struck from cuttings which are not easily germinated or rooted in the open ground and in the ordinary manner, hot-beds, frames, and hand-glasses are also requisite. Every private garden of any extent requires a nursery to raise and bring forward young plants as a reserve for supplying failures by disease or accident in the general garden.

"The seeds of the trees to be cultivated are first sown in what are termed the seed beds. The pits of peaches and stone fruits may be either broken, or placed in wet sand in the fall, so as to open in the spring of themselves. The beds may be made about four feet wide, with little paths for passages between.

"The ground of these beds being carefully digged, and rendered smooth by the rake, and a little of the surface soil being laid aside for the purpose of covering the seeds, these are to be scattered evenly over the surface, and a light wooden roller then passing over it, the earth which had been laid aside is to be spread carefully and equally over the seeds.

"The seeds of resinous trees must be lightly covered, and so also must some of the hard-wood kinds. Those of the larch and the spruce should be covered about a quarter of an inch, and sown in the month of April, while those of the oak, the ash, the chestnut, the sycamore, and others, may be more deeply covered, and sown at an earlier season. But some of the hard-wood kinds require to be sown at a later period, on account of their being subject to injury from frost; and some may be sown in summer and autumn.

"The young plants remain in the seed beds for one or two years, during which period they are termed *seedlings*. Some of the hardier species, as the larch and pine, may be transplanted at once from the seed beds to the place which they are to occupy in the forest, while others, including several of the resinous, and all the hard-wood kinds, are first transplanted into lines in another part of the nursery, where they remain for one or more years, and then are transplanted to their place in the forest.

The most of the resinous trees, when they are to be transplanted into the nursery lines, may be one year's seedlings; others of the resinous, and all the hard-wood kinds, should not generally be less than two years' seedlings before being transplanted to the lines. Those that require grafting are worked either in the first or second year, and removed the next season. The transplantation from the seed beds to the nursery lines may take place in autumn, after the descent of the sap, or in spring, before vegetation has commenced. The operation may be performed by the spade, but is often performed by the dibble. The plants are set at such distances in the rows that the horizontal branches of the young trees shall not interfere with one another. In transplanting, no part of the root should be lopped or shortened by the knife, nor the roots doubled in putting them into the ground; and care should be taken in planting, where the dibble is used, that the root shall be fixed firmly, without being compressed at the neck.

"Certain kinds of tree plants, instead of being propagated by seeds, are propagated by cuttings, consisting of a portion of the shoot of the previous year's growth, twelve or fifteen inches long. These cuttings are planted by thrusting one end a few inches into the ground. This is the manner in which willows and certain poplars are raised.

"Certain kinds, again, are best propagated by layers. This practice consists in bending down the branches of a growing tree, fixing them in the ground by means of crooked pins of wood, and covering them partly with earth. In this state the covered part quickly shoots forth roots, and the branch, being then separated from the parent tree, becomes a distinct plant.

"But, in the case of the greater number of species, the practice is to sow the seeds in the seed beds in the manner described. The hardier are often planted at once, but most of the hard-wood are not planted in the forest until they have been one or more years in the nursery lines, where they extend their roots, and acquire strength and size.

"During the period in which the plants remain in these lines they are to be kept free from weeds. They require no pruning at this early stage farther than to the extent of causing the leading or principal ascending shoot to preserve its ascendency over the lateral and more horizontal ones, so that the plant shall not become what is termed forked. This may be simply effected by shortening one of the branches, or by simply nipping off the terminal bud of the branch, by which means its vertical growth will be interrupted, and the main stem permitted to preserve its ascendency."

NURSES IN PLANTATIONS. Shrubs or trees which grow rapidly and protect the young plants. Thus the vine is used as a nurse to the cork-oak in Spain. By this means a profit is obtained from the soil. They must not shade the trees too much.

NUT, NUX. A fruit with a hard covering, indehiscent, with one seed (*nucula*).

NUTANT, NUTANS. Nodding, inclined forward, or to the ground.

NUT OF A SCREW. The head, or piece of wood or metal turned down upon the screw.

NUTMEGS. "The fruit of the *Myristica moschata*, a beautiful tree of the family of the *Laurineæ* of Jussieu, which grows in the Molucca Islands. All the parts of this tree are very aromatic, but only those portions of the fruit called mace and nutmeg are sent into the market. The entire fruit is a species of *drupa*, of an ovoid form, of the size of a peach, and furrowed longitudinally. The nutmeg is the innermost kernel or seed, contained in a thin shell, which is surrounded by the mace; and this, again, is enclosed in a tough, fleshy skin, which, opening at the tip, separates into two valves. The nutmeg-tree yields three crops annually: one in April, which is the best, one in August, and one in December.

"Good nutmegs should be dense, and feel heavy in the hand. When

OAK

they have been perforated by worms, they feel light; and though the holes have been fraudulently stopped, the unsound ones may be easily detected by this criterion.

"Nutmegs afford two oily products: 1. Butter of nutmeg, vulgarly called oil of mace, is obtained in the Moluccas, by expression, from the fresh nutmegs, to the amount of fifty per cent. of their weight. It is a reddish-yellow, butter-like substance, interspersed with light and dark streaks, and possesses the agreeable smell and taste of the nutmeg, from the presence of a volatile oil. It consists of two fats: one reddish and soft, soluble in cold alcohol; another white and solid, soluble in hot alcohol. 2. The volatile oil is solid, or *stercoptene*, and has been styled *myristicine*."

The nutmegs are exclusively tropical, and found in America as well as India. The Santa Fé nutmeg is the *Myristica otoba*.

NUTRITION. The manner in which a living animal or plant, or any part of their structure, is sustained, and the organs preserved from waste and decay.

NUX VOMICA. The seeds of the *Strychnos nux vomica*, a tree of India. They are very poisonous, and contain strychnia and brucia.

NYMPH. A pupa, or grub.

O.

OAK. Trees of the genus *Quercus*, remarkable for the durability and toughness of their timber, their size, and handsome appearance. Their acorns are also of considerable value as food for pigs, and in Europe are often collected and sold as produce. The oaks require, for the most part, a rich, clayey soil, rather moist and deep; hence many oak lands form good wheat soils. The following is Michaux's classification of American oaks, including three exotics only:

FIRST DIVISION.

Fructification annual.

FIRST SECTION.—*Leaves lobed.*

1. White oak (*Quercus alba*), seventy to eighty feet high.
2. Common European oak (*Quercus robur*), sixty to eighty feet high.
3. European white oak (*Quercus robur pedunculata*), sixty to eighty feet high.
4. Mossy-cup oak (*Quercus olivæformis*), seventy to eighty feet high.
5. Over-cup white oak (*Quercus macrocarpa*), seventy to eighty feet high.
6. Post oak (*Quercus obtusiloba*), thirty to fifty feet high.
7. Over-cup oak (*Quercus lyrata*), sixty to seventy feet high.

SECOND SECTION.—*Leaves toothed.*

8. Swamp white oak (*Quercus bicolor*), sixty to seventy feet high.
9. Chestnut white oak (*Quercus prinos*), seventy to eighty feet high.
10. Rock chestnut oak (*Quercus montana*), thirty to forty feet high.
11. Yellow oak (*Quercus acuminata*), sixty to seventy feet high.
12. Small chestnut oak (*Quercus chinquapin*), a shrub of three to four feet high.

SECOND DIVISION.

Fructification biennial; leaves mucronated (except in the 13th species).

FIRST SECTION.—*Leaves obtuse or entire.*

13. Live oak (*Quercus virens*), evergreen, forty to sixty feet high.
14. Cork oak (*Quercus suber*), Spanish tree.
15. Willow oak (*Quercus phellos*), thirty to sixty feet high.
16. Laurel oak (*Quercus imbricario*), shingle oak, forty to fifty feet high.
17. Upland willow oak (*Quercus cinerea*), evergreen Southern, twenty feet high.
18. Running oak (*Quercus pumila*), two feet high.

SECOND SECTION.—*Leaves lobed.*

19. Bartram oak (*Quercus heterophylla*), said to be found only on one plantation.
20. Water oak (*Quercus aquatica*), thirty to forty feet high.
21. Black Jack oak (*Quercus ferruginea*), small, barren oak.
22. Bear oak (*Quercus banisteri, v. ilicifolia*), two to nine feet high.

THIRD SECTION.—*Leaves multifid, or many-cleft.*

23. Barren scrub oak (*Quercus Catesbæi*), fifteen to thirty feet high.
24. Spanish oak (*Quercus falcata*), seventy to eighty feet high.
25. Black oak (*Quercus tinctoria*), sixty to seventy feet high.
26. Scarlet oak (*Quercus coccinea*), eighty feet high: produces brownish ink galls.
27. Gray oak (*Quercus ambigua*), a hybrid, seventy to eighty feet high.
28. Pin oak (*Quercus palustris*), forty to sixty feet high.
29. Red oak (*Quercus rubra*), seventy to eighty feet high."

To this list a few others have been added, and some of the names of Michaux changed. Of the additions, the Southern (*Q. Michauxii*), fifty to sixty feet high, is the most important. The list is, indeed, extended now to some forty-five trees and shrubs, but many of these are unquestionably hybrids, or varieties, in which list *Q. ambigua, hemispherica, humulis, obtusa, mollis*, and others are to be reckoned.

The most important of this noble class of trees is the white oak (*Q. alba*), which is especially developed on the clay and calcareous soils of the Middle States: it is a close-grained, tough, and durable wood, extensively employed in building, naval structures, and almost every purpose. The black oak (*Q. tinctoria*) yields a good timber, but it is porous, and inferior to the preceding; the bark is, however, much employed for tanning, and the inner bark yields the quercitron bark, extensively exported as a yellow dye-stuff. The bark of *Q. acuminata vel castanea*, a northern tree, is also used for a yellow dye. The bark of the Spanish oak is preferred for tanning, but the wood is liable to worms. The *Q. virens*, Florida, or live oak, produces a timber of remarkable toughness and durability, said to be superior to all other kinds for naval purposes. It is not extensively developed, and grows in swampy situations.

The proper time for felling timber is a question much agitated; from October to March is adopted by the French; mid-winter by the English. Duhamel examined this subject thoroughly, and concluded that the time was by no means important, for that timber felled in summer, and carefully seasoned, was as tough and durable as winter-felled. Barking is practised in June and July, and it is an advantage to allow the tree to stand until the fall, and then fell for timber; indeed, Duhamel recommends that it be allowed to stand two years after, and this is practised by the Dutch, and in some measure by the English. It is not, however, to be recommended for more than one season, since the moisture of a swamp and other causes may bring on the growth of fungi.

OAK APPLE. A spongy excrescence growing on the young stems of various oaks, especially the red oak; it is produced by an insect, the *Cynips confluentus*. On the white oak, excrescences, very nearly resembling small gall-nuts, are produced by the *C. oneratus*. Other species of cynips sting the various oaks, forming excrescences more or less large; of these, the gall-nuts of the white and scarlet oak are most used for making ink, and the former closely resemble the commercial galls.

OAK BARK. The innermost layer of the black and Spanish bark are of the greatest service in tanning; the tan often amounts to 77 parts in the 100 in this bark during the spring, but is very much less in autumn and winter: the difference, as ascertained by Mr. Higgins, is upward of two thirds. The bark, when split off, should be set up in loose piles to dry, the pieces being so placed as to throw off water, which injures its quality. As soon as dry it ought to be kept under a shed, and not ground till wanted. The exhausted bark of the tanner is much used by gardeners for various purposes, and when rotted, forms a good humus manure. See *Bark* and *Tan*.

OAK PRUNER. Oaks are infested by numerous insects, the most curious of which is the pruner (*Stenoco-*

rus putator), which severs the young branches; these contain the insect, and if collected in the autumn, when just fallen, and burned, will serve as a means of destroying them.

OAKUM. The yarns of hemp, which are spun into ropes.

OASIS. A green spot in a desert; usually a valley.

OAST, OAST-HOUSE. A drying-house, heated by hot air circulating in pipes or flues. It differs in this respect from a kiln, in which the smoke and heat pass into the grain. It is used in drying hops and malt.

OAT-FIELD LAND. Open or unenclosed arable land.

OAT GRASS. The *Avena* genus. See *Grasses*.

OAT MEAL. The flour of oats, especially the Scotch oat; it is extensively employed for cakes, like batter cakes, and for porridge or brose. Oat meal is very nutritious, and frequently much more so than wheat or corn, this point depending upon the proportion of gluten or albumen they contain. The oat meal cakes are allowed to ferment slightly, so as tc become acid (lactic acid) before being used. For the production of meal, the oats are first kiln-dried, then passed through a coarse-set mill to separate the hull or shellings; this forms *groats* or *grits*, and they are then ground in a mill into a coarse meal.

OATS. *Avena sativa.* A cultivated annual of the gramineous family. Other varieties of the avena are also cultivated, as the *A. orientalis*, Tartarian oat, with a one-sided head; the *A. strigosa*, or bristle-pointed oat. The varieties of the common oat are classified into the *black*, *gray*, and *white*; of these, the black kinds are smallest and lightest, but most hardy; and the white kinds best, especially the imperial, potato, Georgian, and the Dutch or Friesland oat. The Polish oat is one of the finest of the black kind, but requires careful tillage, and scatters. It is urged as an objection to the potato oat that the skin is too hard, so that they are often voided by horses unbroken; it, however, yields the most meal, and rises to 46 pounds the bushel. The common black and gray varieties are often less than 25 pounds the bushel, and seldom reach 30; but the Polish is said to reach 50 pounds.

Oats do better north of Philadelphia than south, although they can be cultivated to the Gulf of Mexico; their habitat is, however, northern. This plant grows so rapidly in a good soil that it is not uncommon to obtain two crops in a year, especially if they be cut for fodder while the grain is in the dough. A good yield is 50 bushels, but 90 bushels have been taken from well-prepared soils. The straw varies from $1\frac{1}{2}$ to 3 tons the acre. As food for horses, nothing except beans can be compared with oats; Indian corn is much too oily: while oats contain about four per cent. of oil, Indian corn rises above 10 per cent. In point of nutritiousness they are also superior to corn, and are equal to double their weight of fine hay: the straw of a greenish tinge is the best kind of cereal straw for fodder, and about a quarter the value of prime hay. A draught horse should receive from seven to nine pounds of oats daily, with as much prime hay and straw: this is the ration for the heavy French cavalry. The following is by the Rev. W. L. Rham:

"The great use of oats, and the ease with which they are raised on almost every kind of soil, from the heaviest loam to the lightest sand, have made them occupy a place in almost every rotation of crops. Of all the plants commonly cultivated in the field, oats seem to have the greatest power of drawing nourishment from the soil, and hence are justly considered as greatly exhausting the land. With proper management, a crop of oats may give as great a profit on the best land as any other crop, when it is considered that it requires less manure and produces an abundance of straw, which is very fit for the winter food of horses and cattle, especially when aided by roots or other succulent food.

"To make a crop of oats profitable

some attention must be paid to the preparation of the soil and to free it from weeds; for to sow oats on a foul wheat or barley stubble slightly turned in by the plough, as is sometimes done, is the reverse of good husbandry.

"The best oats are raised in Scotland and in Friesland, and in both countries the land is carefully cultivated. In Scotland, oats are generally sown on a grass layer which has been in that state for some years, and sometimes on old pastures which are broken up for the purpose. The crops exceed in bulk and weight of grain all that the most sanguine person, unacquainted with the system, would expect, and in many seasons, not favourable for the wheat crop, oats are much more profitable. Wherever the land is not of a good quality, and wheat is apt to fail, oats are a much safer crop, especially in retentive soils, as rye is on poor sands.

"When oats are sown after turnips, cabbages, or any other green crop, the land should be well ploughed, if the green crop was not consumed on the spot, and a moderate supply of manure will be well repaid by the increased produce. A heavy loam is best suited for oats: they require a certain degree of moisture, and a deep soil is very favourable to their growth. On land which has been trenched, or where the subsoil plough has been used, after careful draining, if required, oats will thrive wonderfully without requiring so rich a soil as barley or wheat. The roots are hardier, and have a stronger vegetative power. When once they have struck deep into the soil, a good crop, according to the quality of the land, may be relied on.

"When oats are sown after artificial grasses, the land is seldom ploughed more than once, and the seed is sown on the fresh mould which has been turned up; but, unless the land be very free from weeds, it would be better to plough the sward with a shallow furrow early in autumn. Before winter the scarifier would break the rotten sward, which might then be buried deep by another ploughing. The land would be ready for sowing early in spring, which is a great advantage, both as to the quality of the oat crop and the earlier harvest, especially in those districts where the latter part of the autumn is apt to be stormy and rainy. The land thus treated would be clean, and the fallow, which is often resorted to of necessity after a crop of oats, might be dispensed with, as the weeds have been destroyed and buried deep.

"When oats are sown on light land after turnips, it may be ploughed with as shallow a furrow as will turn in the surface: the preparation for turnips will have sufficiently moved the soil. On poor, moist land, oats are more profitable than barley. Clover and grass seeds may be sown among them with equal advantage, as they will seldom grow so high as to be laid and smother the young clover; and barley is very apt to fail on land subject to retain the water.

"In sowing oats, more seed is often used than of any other grain, because, although the plants tiller where they have room, the straw of the second shoots is weaker, and the grain is not ripe so soon as that of the principal stem; but when the plants rise close and thick, there are no tillers, the main stem is stronger, and the corn is more plump and equal. Six bushels of oats are often sown on an acre; but if they are drilled, four bushels are sufficient; and when dibbled, which is sometimes the case in Norfolk and Suffolk, much less seed is used. A good preparation of the land is of more consequence than a superabundance of seed.

"In a field where oats are sown broad-cast, and covered by the harrows, many seeds remain exposed to the depredation of birds, which soon find them out at a time of the year when food is scarce. When the seed is sown and ploughed in, the same object is attained; but as the furrow must be shallow, in order that the seed may not be buried too deep, the land must have been ploughed before to a considerable depth: in either case, four bushels of seed per acre are an ample allowance. They are sown as soon as frost is out of the ground, but not in land too wet, lest they rot in the soil. A second crop is often ploughed in to enrich the soil, but they are inferior to clover.

"When the ground has been well prepared, there is no necessity for weeding or hoeing the crop as it advances; but if large weeds appear, such as charlock, May-weed, docks, or thistles, they must be carefully weeded out, or else the ground will be so infested with their seeds or roots, that it will be difficult to eradicate them afterward. Oats, when fully ripe, are very apt to shed, and many are lost for want of attention. As soon as the straw turns yellow under the heads, the oats should be reaped, however green the lower part of the straw may be: the straw will be better fodder for cattle, and all the corn will be saved. Oats are generally mown with a scythe, and raked into heaps to dry like hay; but this is a wasteful and slovenly practice. A good crop of oats should be reaped, like wheat, close to the ground, and tied in sheaves. A cradle scythe, or a short Hainault scythe, does the work well in the hands of an expert mower, who should be followed by binders, who gather the straw with their hands, and lay it regularly on the ground, if it be not fit to tie up immediately: the straw should afterward be tied up into sheaves, and set, with the corn uppermost, in shocks of ten or twelve sheaves, leaning against each other, and open at bottom, in order to allow the air to pass through. Thus, in a short time the oats become sufficiently dry to be stacked, or carried immediately into the barn.

"Oats, ground into a coarse meal, form a considerable portion of the food of labourers, and many men in the middle ranks of life in Scotland, Ireland, and the north of England. The meal is simply stirred into boiling water with a little salt, until it becomes of the consistence of a hasty pudding; it is then called porridge, or stirabout; and, when eaten with milk or treacle, makes a wholesome and palatable food. It is sometimes mixed with the thin liquor of boiled meat, or the water in which cabbages or kale have been boiled, and acquires the denomination of beef-brose or kale-brose. When made into a dough with water, and baked on an iron plate in thin cakes, it makes a bread which is very palatable to those who are accustomed to it, and who often prefer it to wheaten bread. In Germany and Switzerland the coarsely-bruised oatmeal is put into an oven till it becomes of a brown colour; it is then called habermeel, and is used in broths and pottages, as the semolina, made from wheat, is used in France and Italy. The coarsely-broken grains, after the husk has been removed, form grits, which are extensively used to make gruel for children and invalids. The chaff of oats, put into a canvass bag, forms a good substitute for feather beds.

"In some countries the oats are given to horses in the straw, without thrashing them; and, where the quantity can be regulated, the practice is good. The horses masticate the corn better in the chaff, and the straw is wholesome; but where horses do hard work they would be too long in eating a sufficient quantity, and it is better to give them oats thrashed and cleaned, with clover hay cut into chaff. When hay is dear, it is often cheaper to increase the quantity of oats, and to give it with wheat straw cut fine. In this way very little hay is required. The calculation is easily made, when we consider that a pound of good oats gives as much nourishment to a horse as two pounds of the best clover or sainfoin hay. A truss of hay of 56 pounds is therefore equal to 28 pounds of oats, or a bushel of the best oats will go as far as one truss and a half of hay.

"Farmers who have hay-ricks, from which they often allow their men to take as much as they please for their horses, will carefully measure out the oats, which probably are much cheaper. Some men, who keep many horses, cut all the hay into chaff by a machine, and, mixing this with a proper proportion of oats, feed all their horses in mangers with a certain allowance of the mixture, a practice much more economical than that usually adopted. In France and Germany the practice of baking oats, as well as rye, into loaves for horse food, is gaining ground, and is said to be attended with an evident saving of food."

The oat is a pretty sure crop; the smut and chinch-bug sometimes reduce the yield, and rust impoverishes the straw; but as these enemies come late, it is best to cut the crop as early as they appear: the wire-worm sometimes destroys a portion.

OATS, COMPOSITION OF. The general composition of the oat is similar to the other cerealia, and the special compost given for wheat will serve for this crop and for barley. By Boussingault, the yield of an acre perfectly dry in grain is 975 pounds; straw, 1176 in the dried state (small crop); the ashes, 4·0 per cent. grain, 5·1 straw, or, per acre, 39 pounds for the grain, and 60 pounds for the straw. The composition of the ash, per cent., was,

	Grain.	Straw.
Potash	12·9	24·5
Soda	0·0	4·4
Lime	3·7	8·3
Magnesia	7·7	2·8
Phosphoric acid	14·9	3·0
Sulphuric acid	1·0	4·1
Silica	53·3	40·0
Chlorine	0·5	4·7
Iron, carbonic acid, and loss	6·0	8·3
	100·0	100·0

It would appear, therefore, that bone earth, common salt, gypsum, and, where the composition can be formed at little expense, silicate of potash, would be excellent manures, and might be combined in compost with nitrate of soda.

The ultimate composition of the grain gives 2·24 per cent. nitrogen; the straw, 0·38; and, according to the Scotch, 14 pounds of oats yield eight of meal.

OB. A very common affix to descriptive words in botany, &c., as obcordate, obrotund, &c., signifying nearly or somewhat heart-shaped, round, &c.

OBESITY. Extreme or morbid fatness.

OBJECT GLASS. The glass, or lens, of the telescope nearest the object.

OBJECT STAFF. The surveyor's staff. See *Levelling Staff.*

OBLATE. Somewhat spherical, but flattened in the perpendicular axis, as an orange, the world.

OBSIDIAN. A black, glassy, compact lava, consisting of potash and soda, 7 to 10 per cent.; silica, 77·50; alumina, 11·75; iron, 1·25.

OBTUNDENTS. Mucilaginous, oily, or bland substances, which reduce the acrimony of other medicines.

OCCIPITAL BONE. The bone which forms the back portion of the skull, to which the spinal column is attached.

OCHRE. Peroxide of iron mixed with clay: the colour is very durable.

OCHREA. The leaf-stems which clasp or surround the stem, as in the case of some grasses.

OCTAGON. A superficial figure, with eight sides or angles.

OCTAHEDRON. A solid, with eight regular sides; it is one of the most common figures of crystals, and may be a derivative from the cube or tetrahedron.

OCTANDRIA (from *οκτω*, *eight*, and *ανηρ*, *male*). The Linnæan class, in which the flowers contain eight stamens.

OCTOBER. This is one of the most important months. Whenever frost begins to occur, all tender roots and potatoes should be stored. Apples, pumpkins, and other fruits are also to be stored. Turnips, parsnips, and carrots may remain in the ground. Hemp, sugar, tobacco, and cotton are either quite or nearly collected. This month is also preferred for timber cutting. Wheat sowing, as well as winter grains, should be drawing to a close, as the season is late except for the South. In the garden and orchard, transplanting and propagation by cuttings, &c., may commence as soon as the leaves have fallen, or in evergreens; arrangements should be made for early vegetables, and the frames looked to. As soon as frost comes on, collect straw and leaves to cover the vegetables remaining in the soil, spinach, turnip tops, &c., and secure the roots and stems of tender fruit or shrubbery plants; prepare for laying vines, &c. Ewes put to the ram this month bring lamb in March, which is seasonable in the South, but too early for the North.

ODERITE. A species of black mica.

ODOMETER (from ὁδος, *a road*, and μετρον, *a measure*). A wheel, the axis of which turns a graduated scale, so that the distance over which it passes on a road is recorded in feet and miles. It may be attached to a carriage wheel, or rolled along by the hand

ODONTOLOGY (from οδους, *a tooth*, and λογος). A treatise on the teeth.

ODORIN. A very concentrated empyreumatic oil, obtained by rectifying oil of bones.

ŒDEMA. Puffiness of a part of the body, produced by a dropsical effusion or collection of watery fluid.

ŒNANTHIC ETHER. A volatile oily body, to which the peculiar vinous flavour of wine is owing; by boiling with potash it becomes converted into œnanthic acid and alcohol. Liebig traces its existence to the free tartaric and racemic acids of certain grapes, which yield the oil by their transformation.

ŒSOPHAGUS. The gullet or swallow.

ŒSTRUS. The genus of *Gad Flies*, which see; as also *Insects*.

OFFSET. In building, the superior surface left uncovered by the continuation upward of a wall where the thickness diminishes, forming a ledge.

OFFSETS. In surveying, short distances from the chain-line, usually measured with a rod, called an offset-staff, the most convenient length for which is 6 feet 7·2 inches, being equal to 10 links of the surveying chain.

OFFSETS. In gardening, young radical bulbs, when separated or taken off from the parent roots, are so called. One of the chief methods of propagating plants is by offsets.

OGEE. In moulding, is a line resembling the italic *f*.

OGIVE. The pointed arch.

OIL-CAKE. The remains of seeds, especially linseed, after expression for oil. Linseed and several other cakes are used for fattening, two to four pounds being broken up into the daily food; it is remarkably rich in oil, containing often 15 per cent., and ranks high as nutriment. See *Fodders*. Animals do not always take to it readily, and are therefore to be gradually fed. Rape, mustard, hemp, castor oil, and other cakes are admirable manures; half a ton of rape cake, well broken and sown broadcast, is a well-established manure in England. The Flemish mix them with their fluid manure. See *Flanders Husbandry*. The cake of any particular seed is the best manure for the same crop. They are suitable for the drill.

OIL OF BRANDY, OIL OF POTATOES, OIL OF GRAIN SPIRIT, FOUSEL OIL. This volatile aromatic oil is formed in the fermentation of potatoes or grains where hops are not employed, and which yield an alkaline mash; it comes over in the last portion of the distillation for the alcohol; when concentrated, it is oily and very nauseous. It is also called amylic alcohol, and bihydrate of amylene: formula $(C_{10} H_{11})$, O HO, the first term being the compound radical *Amyl* of Dumas.

OIL OF VITRIOL. Sulphuric acid.

OIL OF WINE. Two liquid oily bodies, as well as the œnanthic ether, are known by this name; the former arise from distilling ether off caustic lime, and are sulphates of the oxide of ethyl.

OILS. Compounds consisting of carbon and hydrogen for the most part, but occasionally containing oxygen, and having an affinity for that element, whereby they become rancid or are converted into resins. They are compounds of the margaric, oleic, or stearic acids, with glycerine, and owe their value not only to their peculiar properties, but to the soaps and liniments they form with alkaline substances. They are in all respects fluid fats of vegetable and animal origin, agreeing very closely in structure. Thus per cent.,

	Carbon.	Hydrogen.	Oxygen.
Olive oil consists of	77·2	13·3	9·5
Spermaceti "	78·0	11·8	10·2

Oils are divided into expressed or fixed oils, which are also subdivided into drying oils and common oils, and into distilled or essential oils. The *common fat* oils are like almond and olive, bland, preserving their flavour for a long time, but becoming rancid; palm oil is solid. The *drying* oils are like linseed, hemp seed, nut oil; they attract oxygen readily from the air, evolving heat, and become solid. The *essential* oils impart to flowers and aromatic bodies their odour; they are very volatile, and are obtained by distilling the leaves or flowers with water. All vegetables contain a proportion of oil of some of these varieties, which may be obtained by digesting them in ether and alcohol; it is, however, frequently below one per cent., while in other cases, as the nut, it is more than sixty per cent. In provender, the fattening quality is closely related to the per centage of common oil. The following table contains the best information on this topic:

Common maize . . .	8 to 12 per cent.
Rice	0·8 "
Oats	5·5 "
Ditto	3.3 "
Rye	1·8 "
Rye flour	3·5 "
Hard wheat	2·6 "
Wheat flour	2·1 "
Ditto	1·4 "
Fine bran	4·8 "
Coarse bran	5·2 "
Dry clover	4·0 "
Dry lucern	3·5 "
Meadow hay	3·8 "
Oat straw	5·1 "
Bean meal	2·1 "
Beans	2·0 "
Haricots	3·0 "
Peas	2·0 per cent.
Lentils	2·5 "
Potatoes	0·08 "
Mangel-wurzel	0·1 "
Carrots	0·17 "
Oil-cake	9·0 to 15 "

M. Payen found that the oil was everywhere present in the seeds of gramineous plants. The embryo contains much, the husk less, the farinaceous portion still less; but maize and oil-cake contain about 9 per cent., whence the universally admitted superior fattening power of these two articles.

The crops enumerated in the following table are those principally raised for oil (the bene might be added): it is from Boussingault:

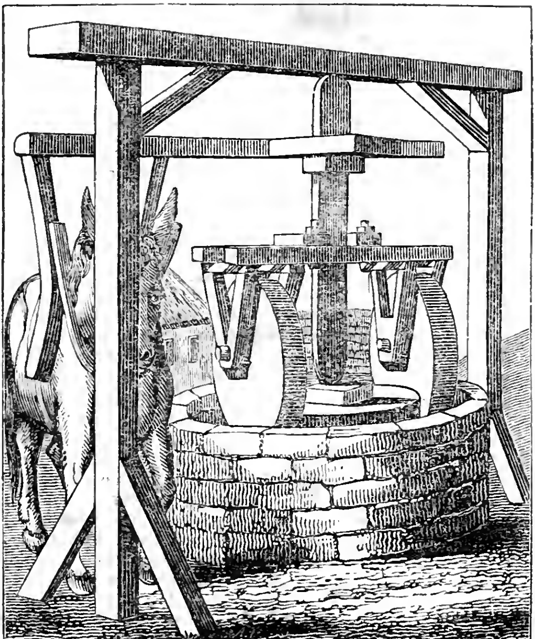
Crop.	Seed produced per acre in Cwts.	qrs.	lbs.	Whole quantity of Oil obtained per Acre in lbs. avoird.	Oil obtained per cent.	Cake per cent.
Colewort . . .	19	0	15	875·4	40	54
Rocket . . .	15	1	3	320·8	18	73
Rape	16	2	18	641·6	33	62
Swedish turnip	15	1	25	595·8	33	62
Curled colewort	16	2	18	641·6	33	62
Turnip cabbage	13	3	19	565·4	33	61
Gold of pleasure	17	1	16	545·8	27	72
Sunflower . .	15	3	14	275·0	15	80
Flax	15	1	25	385·0	22	69
White poppy .	10	1	18	560·8	46	52
Hemp	7	3	21	229·0	25	70
Summer rape .	11	3	17	412·5	30	65

A few oils, as the castor and cajeput, are eminently medicinal, although expressed; this arises from the presence of peculiar principles in them. Camphor is by some writers regarded as a concrete volatile oil.

The process for procuring expressed oils is either conducted with or without heat; where no heat is employed, less, but a superior kind is obtained, which resists the action of air longer, and is of a more delicate flavour. For virgin oils the seeds are first crushed, either between iron rollers, in mortars, or in an edge mill, resembling the bark mill (see *Oil Mill*); the crushed mass is then enclosed in strong hempen or woollen bags, and this often in another of horse hair, and subjected to the pressure of a screw, placed in a hydraulic oil mill, or merely into press boxes of stout materials, and pressed by driving wedges perpendicularly between the sides of the box and bags. The hydraulic arrangement is most effective. (See *Press, Hydraulic*) The oil is collected as it flows into appropriate casks or vessels. The cake is now boiled, heated by hot water, or pressed between hot plates in the hydraulic press; by this means more oil is obtained, which, if water be used, rises, after a time, to the surface, and may be skimmed off. Coarse oils, as castor, hemp, cotton, &c., can be heated in an oven, or over flues, or parboiled in the first case; but olive, almond, and table oils should not be heated, the second drawing being fit only for machinery. The cake or marc is always serviceable as food or manure. Sometimes oils are obtained by merely bruising, and then boiling in a great deal of water, the floating produce being taken off by skimming; but this is a very objectionable method for table oils. For farther particulars, see the oil plants.

OILS AS MANURE. Train oil and blubber have been recommended, and much used in composts as manures; and, from some of the results, many farmers have taken up an idea that oils are great fertilizers. Train oil and other animal oils contain impurities rich in nitrogen, and their decay produces a fertilizing action, but otherwise it is difficult to understand that oils should be, to any extent, manures. The idea is probably erroneous, although of very ancient date; but the old writers were altogether in the wrong in calling night soil and such bodies oily compounds; they do not, therefore, speak of real oils in many of their observations.

OIL MILL. This is made in several ways, but the most common is that called the edge mill, the stones of which are large and heavy. See *Figure*.



OINTMENT. A medical preparation containing lard, suet, or fat as a basis.

OKRA. *Hibiscus esculentus.* An annual of the family *Malvaceæ*, abounding in a ropy mucus. It is readily cultivated, and much valued for soups and as a vegetable, served with butter. It is said that the ripe seeds, which are as large as a small pea, when roasted and prepared like coffee, are a perfect substitute for that product. They are sowed in settled weather (May), in rich lands, in drills three feet apart each way, and improved by manure and tillage. The plants grow three or four feet high, and bear numerous pods, which are cut green, and while sufficiently tender to break across. In good situations they grow six to ten inches long. They are boiled, and served with butter, or sliced, and introduced into soup, with tomatoes, &c. The green pods also make a good pickle. They are regularly brought to the Southern markets.

OLD RED SANDSTONE. The formation of red sandstones and conglomerates next below the coal.

OLEACEÆ. The family of trees and shrubs containing the olive, ash, and privet.

OLEANDER. *Nerium oleander.* A beautiful evergreen, with large, rosaceous flowers. It requires shelter in the green-house, and is propagated with ease by cuttings kept moist.

OLECRANON. The bone of the elbow. A process of the ulna.

OLEFIANT GAS. An inflammable gas, condensing spontaneously into a fluid oil, with an aromatic odour. It consists of two atoms carbon and two hydrogen. It is regarded as a hydrate of acetyl ($C_4 H_3 + H$).

OLEIC ACID. The acid of olein (*clain*), or the fluid portions of fats, separated by alkalies from the glycerine.

OLERACEOUS. Of the nature of culinary vegetables or pot herbs.

OLFACTORY NERVES. The first pair proceeding from the brain, and distributed in the nose.

OLIBANUM. A fragrant Eastern gum resin. Frankincense.

OLIVE. *Olea Europea* (*Fig.*). A

small evergreen tree, requiring a mild climate, similar to that of South Georgia, and a dry, granitic soil. It is propagated from slips or seeds. The trees bear well at ten years, and live for centuries, when undisturbed by frosts. They are more hardy than the orange. The unripe fruit, preserved in salts and water, form an esteemed culinary and desert article. The variety of tree with long leaves (*longifolia*) yields the best table oil. It is cultivated in France. The oil is procured from fruit fully ripe, which is allowed to sweat in heaps for a few days, and then crushed in an edge mill, and pressed without heat. The oil becomes fine by standing for a time.

OLIVE, AMERICAN. *Olea Americana.* Devil wood. A large evergreen shrub of the South, growing near the seashore, with aromatic flowers and a small fruit. The wood is very hard, but is little used.

OLIVILE. An amylaceous body obtained from the gum of the olive-tree.

OLIVINE. A green, volcanic mineral. A silicate of magnesia and iron.

OMBROMETER (from *ομβρος*, *rain*, and *μετρον*). A rain gauge.

OMENTUM. The membrane or caul that lies over the intestines, and becomes loaded with fat.

OMNIVORES, OMNIVOROUS. Eating animal and vegetable food.

OMPHALODIUM. The point in the hilum or scar of a seed through which the nutritious vessels pass.

ONION. *Allium cepa*. The following article is chiefly from Mr. Bridgeman: "*Varieties.*—New-England white, large red, yellow or silver-skinned, yellow Dutch, Strasburgh or Flanders, Madeira.

"Of the several varieties of onions, the yellow or silver-skinned and large red are the best for a general crop. The bulbs are handsome, of firm growth, and keep well through the winter. The New-England white are handsome for the table, and very suitable for pickling, as well as to pull while young, and generally prove a very profitable crop.

"Previous to sowing onion seed for a general crop, the ground should be well prepared by digging in some of the oldest and strongest manure that can be got. The earlier this be done in the spring, the better; and the planting should not be delayed longer than the middle of April. The seed may be sowed moderately thick, in drills one inch deep and twelve inches apart, in April or May.

"Those who cultivate onions for the sake of their bulbs may use at the rate of four or five pounds of seed per acre.

"As market gardeners, in the vicinity of large cities, find it most profitable to pull a great proportion of their onions while young, they generally require at the rate of from eight to ten pounds of seed to an acre of land.

"When the plants are up strong, they should be hoed. Those beds that are to stand for ripening should be thinned out while young, to the distance of two or three inches from each other. If a few should be required for use after this, those can be taken which incline more to tops than roots; and if the beds be frequently looked over, and the small and stalky plants taken away where they stand thickest, the remaining bulbs will grow to a larger size. The plants should be hoed at least three times in the early part of their growth; but if the season prove damp, and weeds vegetate luxuriantly, they must be removed by the hand; because, after the onions have begun to bulb, it would injure them to stir them with a hoe.

"When the greenness is gone out of the tops of onions it is time to take them up, for from this time the fibrous roots decay. After they are pulled they should be laid out to dry, and when dry, removed to a place of shelter."

The crop is put up into ropes of three and a half pounds, and a fair crop is from 6000 to 8000 such ropes.

"The small onions may be planted in the following spring. Even an onion which is partly rotten will produce good bulbs, if the seed stems be taken off as soon as they appear."

The admirable Portuguese onions are only raised in perfection near the seashore, in places moistened by the tide; hence moisture and a little salt should be secured to the growing plants.

"The *Allium fistulosum*, Welsh onion, or Ciboule, is cultivated for spring salad; it forms no bulbs, but is very hardy. If the seed be sowed early in September, in rich ground, although the tops may die down in the winter, yet the roots will continue sound, and put up new leaves early in the spring.

"The *Allium cepa*, or common white and red onions, are most generally cultivated by market gardeners, as a substitute for the *Allium fistulosum*. They sow the seed in the spring and autumn months; the product of which is pulled and sent to the market while young, and generally meets with a ready sale.

"The *Allium proliferum*, or tree onion, is propagated by planting the bulbs in spring or autumn—either the root bulbs or those produced on the top of the stalks; the latter, if planted in the spring, will produce fine onions. These may be planted in rows, with a dibble, the same as shallots.

"The potato onion (*Allium tuberosum*) does not produce seed as other onions, but it increases by the root. One single onion, slightly covered, will produce six or seven in a clump, partly under ground.

"The bulbs are generally planted in the spring, from twelve to eighteen inches apart; but they will yield better when planted in autumn, as they will survive the winter if slightly covered with dung, litter, or leaves of trees, &c."

ONION, WILD. A troublesome weed in meadows and open grounds. It is to be removed by a few hoed crops and heavy liming.

ONISCIDÆ. Insects like the wood louse (*Oniscus*).

OOLITE. Roe stone. A limestone of the secondary epoch, the parts of which are rounded so as to resemble a fish roe. It is unknown as a formation in the United States, at least on the seaboard. Oolitic is a derivative.

OPAL. An iridescent, silicious mineral.

OPEN CUTS. Ditches not covered.

OPERCULUM. A lid or covering. The coverings of the theca of mosses. In zoology this term is applied to the apparatus supported by four bones, which protects the gills of fishes; also to the horny or calcareous plate which closes the aperture of univalve shells; and to the four calcareous pieces which defend the entrance to the tube of *Balanites*, or bell barnacles.

OPHIDIANS, OPHIDIA (from οφις, *a snake*). The order of reptiles resembling snakes.

OPHTHALMIA (from οφθαλμος, *an eye*). Inflammation of the mucous membrane of the eye.

OPIUM. The concrete juice of the poppy, obtained by wounding the unripe seed capsules of the *Papaver somniferum*, collecting the milky juice which exudes and dries in the sun, and kneading it into cakes. The cakes of the best opium are covered externally with pieces of dried leaves and the seed capsules of some species of *Rumex*. It should be of a rich brown colour, tough consistency, and smooth, uniform texture; its peculiar narcotic smell should be strong and fresh; its taste bitter, warm, and somewhat acrid. The chemical analysis of opium has rendered it probable that its activity as a medicine depends upon the presence of a peculiar alkaline base, called *morphia*, in combination with an acid which has been termed *meconic acid*. Opium also contains *narcotine*, *narceine*, *codein*, gum resin, extractive matter, and small portions of other proximate principles.

The chief countries in which opium is prepared are India, Egypt, Turkey, and other parts of Asia; it is even cultivated in Italy, France, and England; but the climate of Europe seems to be too uncertain to allow of its regular production.

There is no substitute for this invaluable drug in allaying pain. See *Poppy*.

OPOBALSAM. Balm of Gilead. A fragrant gum resin, from a species of *Amyris*.

OPODELDOC. A liniment of soap with camphor.

OPOPONAX. A gum resin of a bad odour, from the *Pastinica opoponax*.

OPOSSUM. The genus *Didelphis* of marsupials, peculiar to the American continent.

OPTIC NERVES. The second pair from the brain. They enter the back of the eyes, and form the retina.

OPTICS. The science which investigates the property of light, and all that relates to vision.

ORACHE. The genus *Atriplex*, of the family *Chenopodiaceæ*, which contains the beet and spinach; most of the species are weeds in rich soils, but *A. hortensis* is cultivated and used like spinach in some parts of Europe.

ORANGE. *Citrus aurantium*. This tree and the genus are cultivated only in situations free from frost, and suffer even in Florida; with sufficient shelter to protect them from frost, they are readily raised in orangeries kept above 32° Fahrenheit. They are evergreens: the flowers are large, white, and odoriferous, existing at the same time as the fruit, which is too well known to require description. Orange-trees thrive best in a good loamy soil, mixed with a quantity of rotten dung. The different kinds are procured by budding or grafting on common stocks. Stocks for working upon are raised from any oranges, lemons, &c. They are sometimes raised from cuttings, in which case they produce fruit when very small plants. The flowers of the orange-tree yield, by distillation, a fragrant volatile oil, known by the name of oil of Neroli. The fruit of the bignaroll, or bitter orange, makes one of the best preserves that can be eaten, namely, Scotch marmalade. The unripe fruit is used for flavouring the liquor called Curaçoa. The ripe fruit is wholesome, and a useful refrigerant in fevers."

ORANGE DYE. A mixture of red and yellow dyes.

ORANGE, OSAGE. *Maclaura aurantica.* A small, handsome, deciduous tree or shrub of 15 feet, bearing a large fruit somewhat like an orange in appearance. It is a native of Arkansas, but grows in New-York. Being a branching, thorny, and quick-growing shrub, it has been recommended for hedges; it is readily propagated from seeds, and grows sufficiently in three years to form a fence: the seeds germinate in a few weeks, and one fruit yields some two hundred; three may be set in holes five feet apart, and thinned to one after the first year.

ORANGERY. "A kind of gallery in a garden, or parterre, to preserve orange-trees in during the winter season. For trees in large boxes a proportionably large and lofty house is requisite; it may be opaque on the north side, with a glass roof, front, and ends, of any convenient or desired length, width, and height. For one of moderate size, the height at the back wall may be fifteen feet, at front ten feet, and the width of the house fifteen feet. The floor may be either perfectly level, and the boxes placed on it, the largest behind, so as their tops may form a slope to the front glass; or if the trees are young, a stage may be erected for a few years, in order to raise the plants to the light; but if the trees are of a considerable size, the best way is to have square pits in the floor at regular distances, somewhat larger than each box, and in these to sink the boxes, covering them with mould, sand, or moss, nearly to the level of the pavement, so that each tree so placed and dressed will appear as if placed in a small compartment of earth."

ORANGE, WILD. *Prunus Caroliniana.* A kind of cherry evergreen, and growing to the size of a small tree; the fruit is not edible, but the tree is much esteemed on the Southern seaboard as an ornamental plant. It is a native of Florida.

ORBIT. In birds, the skin which surrounds the eye: the bony cavity in which the eye is set.

ORCHARD. A collection of fruit-trees. The operations of the orchard are to be found under their respective heads. The best soil is somewhat calcareous or marly for the *Pomaceæ*, or apples, pears, peaches, cherries, plums, and apricots; but the "hard gravelly soil of the Eastern States, the sandy soil of New Jersey, the clay soil of Pennsylvania, and the rich alluvial bottoms of the West, all produce an abundance of the different varieties of fruit, when proper attention is given to the trees. Mr. Phinney, of Lexington, Massachusetts, has ditched and drained one of his swamps, and has now on it a luxuriant orchard of apple-trees. *The great point is to have a dry soil.* If it is not sufficiently rich, make it so; no man should *expect* to have *fine* crops of anything unless his soil is rich.

"*Setting out Trees* (*Mr. Pell's plan*).—If by exposure the roots have become dry, immerse them in water for 20 or 30 hours previous to setting them out. Prepare a compost as follows: Take 3 bushels of rich soil, or 3 bushels of swamp muck would be better, 1 bushel night soil, 1 bushel fine charcoal (if charcoal is plenty, 3 to 4 bushels are to be preferred), 1 bushel air-slacked lime, 1 bushel of leached wood ashes, and 1 peck of salt. Mix the above well together.

"Dig the holes 3 feet wide, 2 feet deep, keeping the top soil by itself; fill in a portion of the bottom soil until nearly ready for the tree, then fill in half a bushel of the compost and set in the tree, spreading out the roots to their natural position, and fill in the top soil, gently shaking the tree two or three times to settle the soil around the roots. The tree should be set the same depth in the orchard that it stood in the nursery. Leave the soil a little hollowing about the tree, to catch and retain the rain-water. Put around each tree half a peck of fine charcoal and half a peck of slacked lime. With these precautions neither peach nor any other fruit trees will be infested with worms at the roots, provided they have suitable after-culture.

"*Culture of Orchards.* — The soil around the trees should be kept loose, either by spading, digging with a mattock, or by ploughing. If a crop is put in the orchard, nothing should be planted or sowed within five feet of the trees, as the nourishment taken up by the crop is so much taken from the growth of the trees. After the lime and charcoal has laid around the trees one year, spread it around the trees in a circle of ten feet in diameter. This should be done in the spring, when the soil is cultivated, and a fresh supply of lime and charcoal applied.

"When the trees have been set out three or four years, the soil should be enriched with a compost of manure, swamp muck, and ashes. Early every spring the trunks of the trees should be washed with strong lye, strong soapsuds, or thin soft soap. Apply either of these with a whitewash brush as high as a man can reach. When the trees grow rapidly, their girth will be increased by slitting the outer bark the whole length, from the ground up to the limbs. This gives the trees room to expand.

"*To render Old and Barren Orchards Thrifty and Productive.*—Early in the spring plough the entire orchard, and enrich with a compost of manure, swamp muck, lime, and chip manure. Scrape off all the old bark with a deck scraper, or a hoe ground sharp. Apply half a bushel slacked lime, and the same of fine charcoal, around each tree. Apply then soft soap or strong soapsuds on the trunks and limbs as high as a man can reach. While the trees are in full bloom, throw over them a good supply of fine slacked lime.

"*To destroy Caterpillars.*—As soon as the nests can be seen, procure some spirits of turpentine; tie a small piece of sponge to a pole that is long enough to reach the highest nests, fill the sponge, and once filling will be sufficient to rub off and destroy several nests."

ORCHARD GRASS. See *Grasses*.

ORCHIDACEÆ. Herbaceous endogens with remarkably irregular and beautiful flowers; they are propagated by seeds, and bear bulbs containing an agreeable farina (*salep*), for which the *Orchis mascula* is partially cultivated. They are natives of calcareous soils. In the tropics the species and genera often become splendid parasites.

ORCHIL, or ARCHIL. The *Rocella tinctoria*. A lichen indigenous to the Canaries, and yielding a purple dye.

ORCINE. The colouring matter of the *Violaria orcina*, or *lichen dealbatus*.

ORDER. A style of architecture, or column.

OREGON ALDER. *Alnus Oregona.* An alder of 25 to 30 feet.

ORES. Minerals containing a large amount of some metal.

ORGAN. In anatomy, a viscus, or structure of the body.

ORGANIC CHEMISTRY. The chemistry of organic matters, or such as are directly or indirectly derived from plants or animals. The investigation or analysis of such bodies are proximate or ultimate; the former when the parts are merely separated by solvents, as water, alcohol, ether, and acids; the latter when the elementary composition is ascertained. Carbon, hydrogen, oxygen, and nitrogen, combined in binary, ternary, or quarternary compounds, with a small amount of saline matters, form the majority of organic bodies; *sulphur* and *phosphorus* are present in a few only. The modern process of organic analysis is briefly described in Kane's and in Graham's Chemistry. These manipulations require great experience and skill. Vegetable tissues are distinguished from animal by the great amount of nitrogen in the latter.

ORGANIC DISEASE. Disease attended with an alteration of the structure of a viscus or organ.

ORGANIC REMAINS. Fossils.

ORGANIZATION. The processes by which an organized body is formed; also the totality of the parts which constitute, and of the laws which regulate, an organized body.

ORGANOGRAPHY. A description of the structure of plants.

ORLO. The plinth to the base of a column or pedestal.

ORNITHICNITES (from *ορνις, a bird*, and *ιχνος, a trace*). Certain marks in the new red sandstone, supposed to be bird tracks.

ORNITHOLOGY (from *ορνις, a bird*, and *λογος, a description*). The science which teaches the natural history and arrangement of birds.

"The subdivision of the class of birds is by no means so clearly indicated by either external or anatomical characters as that of mammals, and the systems of ornithology present, in consequence, greater discrepancy.

"In the quinary arrangement of birds, proposed by Mr. Vigors, there may be traced a similar principle to that which guided Nitzsch in his ternary classification. Thus, the first order (*Raptores*, Virg.) includes the birds which soar in the upper regions of the air, which build their nests and rear their young on the highest rocks and loftiest trees. The second order (*Incessores*) includes the birds which affect the lower regions of the air, and which are peculiarly arboreal in their habits; whence the name of perchers. The third order corresponds with Nitzsch's *Aves terrestres*, and is termed *Rasores*. If the aquatic birds of Nitzsch be divided into those which frequent the fresh waters, and are restricted to wading into rivers, lakes, &c., in search of their food, and those which have the power of swimming or diving, and, for the most part, frequent the ocean, we shall then have the two remaining orders of the quinary arrangement, viz., *Grallatores* and *Natatores*. The chief merit of this arrangement is its aim to express the natural affinities, and their circular progression in the whole and in the several parts.

"Linnæus and Cuvier have six orders of birds, which are characterized as follows by the latter naturalist:

"Of all classes of animals, that of birds is the most strongly characterized; that in which the species bear the greatest mutual resemblance, and which is separated from all others by the widest interval. Their systematic arrangement is based, as in the mammalia, on the organs of manducation, or the beak, and in those of prehension, which are again the beak, and, more particularly, the feet.

"One is first struck by the character of *webbed feet*, or those wherein the toes are connected by membranes that distinguish all *swimming birds*. The backward position of their feet, the elongation of the sternum, the neck, often longer than the legs, to enable them to reach below them, the close, glossy plumage, impervious to water, altogether concur with the feet to make good navigators of the *Palmipedes*.

"In other birds, which have also most frequently some small web to their feet, at least between the two external toes, we observe elevated tarsi; legs denuded of feathers above the heel joint; a slender shape; in fine, all the requisites for wading in shallow waters in search of nourishment. Such, in fact, is the source of food of the greater number; and although some of them resort exclusively to dry places, they are, nevertheless, termed 'shore birds,' or 'waders' (*Grallæ*).

"Among the true land birds, the *Gallinaceæ* have, like our domestic cock, a heavy carriage, a short flight, the beak moderate, its upper mandible vaulted, the nostrils partly covered by a soft and tumid scale, and always the edges of the toes indented, with short membranes between the bases of those in front. They subsist chiefly on grain.

"Birds of prey (*Accipitres*) have a crooked beak, with its point sharp and curving downward, and the nostrils pierced in a membrane that invests its base: their feet are armed with strong talons. They live on flesh, and pursue other birds; their flight, accordingly, is mostly powerful. The greater number still retain a slight web between their external toes.

"The passerine birds (*Passeres*) comprise many more species than all the other families; but their organization presents so many analogies that they cannot be separated, although they vary much in size and strength.

"Finally, the name of climbers (*Scansores*) is applied to those birds in which the external toe is directed backward like the thumb, because the greater number of them avail themselves of a conformation so favourable for a vertical position to climb the trunks of trees.

"The primary division of the class of birds adopted by the author of the article 'Aves,' in the *Cyclopædia of Anatomy and Physiology*, includes seven orders; the struthious birds, by virtue of their remarkable anatomical peculiarities, being separated from the *Grallæ* of Linnæus and Cuvier. The following are the orders:

1. Raptores, *Accipitres*, Linn., Cuv. Birds of prey.
2. Incessores, *Passeres*, Cuv. Perchers.
3. Scansores, Cuv. Climbers.
4. Rasores. *Gallinæ*. Linn., Cuv. Scratchers.
5. Cursores, Illig. Coursers.
6. Grallatores, *Grallæ*, Linn. Waders.
7. Natatores, *Palmipedes*, Cuv.; *Anseres*, Linn. Swimmers."

ORPIMENT. Yellow sulphuret of arsenic: it is poisonous; the solution in liquor ammonia has been used as a yellow dye.

ORPINE. *Sedum telephium.* An exotic perennial succulent plant, of the family *Crassulaceæ.*

ORRIS. *Iris Florentina.* The root of this flag is remarkably fragrant, and used in powder as a dentifrice. It is readily cultivated in moist, light soils, and grows rapidly from offsets.

ORTHOPNŒA. Difficulty of breathing, especially when lying down.

ORTHOPTERANS. See *Insects.*

ORTHOTROPOUS (from *ορθος*, *straight*, and *τρεπω*, *I turn*). Seeds in which the hilum and foramen are opposite.

ORTOLAN. A bird of passage of the family *Fringillidæ.* They migrate from Africa to Southern Europe, and are fattened for the tables of the luxurious.

ORYZA (from *Aruz, Arabian*). The genus of the rices.

OSCILLATION. Movement similar to that of the pendulum.

OSCILLATORIA. Plants of the lowest organization, living in wet or damp places, and consisting of threads, which have sometimes an apparent movement.

OSIER. *Salix viminalis.* Common osier; there are, however, other useful species, but this only is acclimated in the United States; the *S. Forbiana* is cultivated in England for fine baskets, and also the *S. rubra.* They are botanically willows, but are remarkable for their slender and tough twigs, which answer admirably for baskets and hoops; for the first, they are cut annually; for the second, every two years. They require a marshy, rich soil.

"In the fens of the east of England, many holts (as they are provincially called) or plantations of osiers are raised, which beautify the country, keep the stock warm in the winter, and provide much useful wood for baskets and all kinds of wicker-work. The mode of planting is very simple: it is, first, to dig the land from six to twelve inches deep, and then to prick down cuttings of four years' growth, and eighteen inches long, about three feet apart. The soil may be moor or clay, or any that is low and wet."

OSMAZOME. The brown, fragrant extractive matter of roasted meats.

OSMIUM. A rare metal, associated with platina in ores.

OSSEOUS BRECCIA. Fragments of bones and mineral matters found cemented together in some caverns and fissures of rocks.

OSSIFICATION. The process of the deposition of bone.

OSTEOLOGY. A dissertation on bones.

OTITIS (from *ους*, *the ear*). Inflammation of the internal parts of the ear.

OTTO, or ATTAR. A perfume, the essential oil of roses. The fresh flowers are distilled with water by a gentle heat, as in the case of other essences.

OUNCE. In troy weight, 480 grains, $\frac{1}{12}$ of a pound; in avoirdupois, $\frac{1}{16}$ of a pound; it contains only $437\frac{1}{2}$ troy grains.

OURARI. A virulent poison from the *Strychnos toxifera*, of Guiana. It produces convulsions and suspended respiration.

OUTCROP. In geology, the exposure of rocks or strata above the earth.

OUTFALL. The lower end of a water-course.

OUTFIELD. Unenclosed lands, distant from the farm-stead.

OUTLIER. A detached portion of rock, distant from the mass.

OUTRE. Unusual, unnatural, without taste.

OUZE. The muddy deposites of the sea, or waters.

OVARIA. The oval bodies which contain the eggs, or germs, in female animals.

OVARIUM. "In plants, a hollow case, enclosing ovules or young seeds, containing one or more cells, and ultimately becoming the fruit; it is always situated in the centre of the flower, and, together with the style and stigma, constitute the female system of the vegetable kingdom. When it is united to the calyx, it is called inferior; when separate from it, it is termed superior."

OVEN. A domestic furnace used for baking bread, pies, tarts, &c. Ovens are generally constructed of brick-work, with a semicircular and very low roof; the bottom is laid with stone, and in the front is a small aperture and door, by the shutting of which the heat is confined while the bread is baking. They are usually heated by means of dry fagots, wood, &c., introduced into the cavity, and are without any grate below. As these ovens, however, are not calculated for small families, on account of the quantity of fuel they consume, others have been contrived, on a more diminutive scale; these are usually formed of cast iron, and may be heated by the same fire which serves for the cooking of other provisions, the hot ashes being applied upon the lid, as well as below the oven; but for baking bread they are inferior to the brick (or Dutch) oven.

OVERLAND FARM. Without buildings.

OVERSHOT WHEEL. That form in which the water falls from above the wheel upon the upper parts. It is the common kind.

OVIDUCT. Fallopian tube, a membranous tube which conveys the germs, or eggs, from the ovarium into the womb, or out of the body.

OVIPAROUS. Producing eggs. Birds, serpents, insects, and fishes are usually oviparous.

OVIPOSITOR. A pointed tube whereby many insects deposite their eggs in holes or chinks; they are sometimes boring or stinging organs (*aculeus*).

OVIS. The generic name of the sheep. The Mouflons are supposed to be the original of our domestic animal, but this is questionable.

OVIVIPAROUS. Producing living young, enclosed within an egg-like membrane; the marsupials, the viper, flesh fly, and several mollusks, are instances.

OVULUM. In botany, the rudimentary seed before impregnation.

OWL. Raptorial or preying and nocturnal birds of the genus *Strix*; they prey on mice and small birds, and are useful to the farmer.

OX. For the varieties, see *Cattle*.

"The ox or steer is the castrated male of neat cattle. He is called an *ox calf*, or *bull calf*, until he is a twelvemonth old, a *steer* until he is four years old, and after that an *ox*, or *bullock*. A sufficient number of the most likely of the male calves being selected for the future propagation of the breed, the others are castrated between the first and third months.

"The advantages derived from the performance of this operation are very great. The nutriment, which is no longer directed to the sexual organs, goes to the general enlargement of the frame; the propensity to fatten is abundantly increased, and the animal becomes far more docile and tractable. The use of the ox in agricultural and other labours may be traced in almost every country, and to periods of the remotest antiquity.

"The education of the steer should commence between the second and third year. At an earlier period he has scarcely sufficient strength, and at a later one he may have become obstinate and self-willed. His education should be founded on patience and kindness, and then the term of it will be far shorter than is generally imagined, and the result will be permanent.

"There has been much dispute with regard to the comparative advantage of the employment of cattle and horses in agricultural labours. The former are said to cost less, and to be supported at less expense. For the latter it is pleaded that a smaller number are needed, that the work is, on pressing occasions, far more quickly performed, and that it is always abundantly greater. The plain matter of fact, however, is, that, although the ox is still used for slow and heavy work on many farms, he is not so generally employed as he used to be, even by his warmest advocates, and the use of him has been completely abandoned by a very considerable number of agriculturists.

"In the native counties of the best breeds, he is still admired and valued as a beast of draught, but by the majority of farmers his value is now chiefly or solely estimated by the quantity and quality of the meat that he will yield, according to the care that is bestowed upon him, and the expense that is incurred. He is in the fullest perfection at four years old, and he will then prove more profitable to the farmer than if he were worked four or five years longer, when the quality of his flesh will be deteriorated, and his disposition to fatten considerably impaired.

"The *diseases* of cattle may be conveniently made the subject of consideration in the present article. They are not so numerous as those of the horse, but there is often considerable difficulty attending the treatment of them. From the peculiar temperament of cattle, and the comparatively great quantity of blood which flows in their veins, promptness in the recognition and the treatment of disease is of far greater consequence than in the horse, rapid as is often the progress of his maladies. Few of the diseases of the horse destroy him at once; but there are many maladies of the ox which must be met at the instant, or they will be uselessly struggled with afterward. Let the owner and the veterinary surgeon take good heed of this.

"The *diseases of calves* should be first considered. They are as numerous as those of the colt, and more fatal. At the head of them stands *diarrhœa*. This sometimes occurs when the calf is suffered to continue by the side of its own dam. Both starvation and excess of food in the mother will produce it; more particularly will this be the case when a foster-mother is employed. If she has calved but a very few weeks before the newly-dropped young one is put to her, the bowels of the calf will almost certainly be disturbed. Where it can conveniently be accomplished, every calf should be reared by its own dam. A state of considerable purging should never be neglected many days, and more especially if the animal loses its gayety or is in evident pain, or the dung is unusually offensive or tinged with blood. The grand cause of this is acidity in the stomach or intestines, which gradually causes inflammation of the inner coat of these vessels. The irritation here set up is communicated to the constitution generally, and exhaustion and death ensue. Then recourse must be had to a compound medicine, the value of which cannot be too highly estimated, and the farmer should never be without it. There should be a base, chalk, to neutralize the acid; an astringent, catechu, to arrest the discharge; a sedative, opium, to allay the irritation; and a carminative, ginger, to support the strength of the patient. These should be mingled in the proportions of eight parts of the first, four of the second, one of the third, and two of the fourth. A large tea-spoonful of this powder should be given twice or thrice in the day, according to circumstances.

"*Costiveness* is a contrary disease to this; it should never be suffered to continue long, for it is fraught with danger. The best aperient for calves and cattle is Epsom salts, in doses of from one to two ounces, with a scruple or half a drachm of ginger.

"*Cough* should be promptly attended to the moment that it is heard. A dose of physic, small doses of powdered foxglove, with nitre, or, in bad cases, a slight bleeding, will usually remove it.

"In proceeding to the diseases of adult cattle, we are struck with the numerous *diseases of the eye*. *Ulceration of the lids* will generally yield to the nitrated ointment of mercury, locally applied, and a course of alterative medicine. *Warts* should be excised by means of a pair of scissors, and the root touched with nitrate of silver.

"For inflammation of the *haw*, or membrane at the corner of the eye, a weak Goulard lotion, or the tincture of opium, lowered with ten times its quantity of water, will be useful; but if there is any fungous growth on the haw, extirpation will afford the only cure. *Inflammation of the eyelids* will generally yield to fomentations of warm water. For *inflammation of the eye*, warm or cold fomentations, the former at the first, and the latter a day or two afterward, with the opiate lotion at the commencement, and a very diluted one of white vitriol—two grains to the ounce—when the inflammation is subdued, with a moderate bleeding or a dose of physic, will constitute the most successful means of cure. *Ulceration of the eye* will be best treated with the opiate lotion, but *cataract* and *gutta serena* do not admit of cure.

"In *fracture of the horn*, if the bones are not quite separated, they may be bound together by tarred cords or splints. If there is a perfect fracture of the bone, it should be sawn off as closely as possible to the head, and a hot iron passed over the surface.

"*Water in the head* in calves, known by the enlargement of the head and the stupidity of the animal, admits not of any cure. The *giddiness* which is sometimes observed in them, and even in the adult beasts—turning round and round—is usually hopeless.

"*Apoplexy*, or sudden determination of the blood to the head, produced by the forcing system being carried too far and the process of fattening hurried too rapidly on, can be cured only by the most decisive measures. The animal that is thus *struck* must be bled until he faints, and powerful purgatives administered and continued.

"*Phrensy* is produced by the same

cause, and can only be cured by the same treatment. In these cases, 15 or 20 drops of the croton oil should be added to the aperient.

"*Locked jaw* too frequently bids defiance to medical treatment; the only hope of cure consists in active bleeding and the continued use of Epsom salts and croton oil, until the bowels are opened. Immediately after the bleeding, the jaws will usually be found sufficiently relaxed to admit of the administration of medicine. This golden opportunity should never be lost. As an adjuvant, a seton of black hellebore in the dewlap may be tried.

"Young cattle are occasionally subject to *fits*. Almost without warning the beast staggers, falls, bellows, and is convulsed in every limb: this is the consequence of over-heating or over-driving, or both. The physic and the fleam must be here put into active use. Perhaps it would be prudent to send such a patient to the butcher with very little delay.

"*Rheumatism.*—There are few diseases of more frequent occurrence among cattle than this. It is not long absent in a low marshy situation, and it is the constant attendant on careless or cruel exposure to cold and wet. It is recognised by the difficulty of motion and the occasional expression of pain. The cure is comprehended in one word, 'comfort.' A little mild physic, with warm, comfortable drinks and gently stimulating applications, will hasten and confirm the cure.

"Connected with, or a consequence of rheumatism, is *swelled joints*, yielding sometimes to stimulating embrocations and comfortable lodging. There are, however, other tumours unconnected with the influence of cold; such are fluctuating tumours, usually about the knees, which require stimulating embrocations, and the occasional use of the *budding-iron*, followed by the application of a blister when the fluid has escaped. Other tumours, also in the neighbourhood of joints, are of a hard character; they will generally yield to frictions with an ointment of the hydriodate of potash, this drug being also administered internally in doses of six or eight grains daily. The too frequent consequence of these affections is *palsy*, at first confined to certain limbs, but gradually spreading over the frame, being, however, most visible in the hind extremities. Here, again, the whole treatment may be included in the comprehensive word 'comfort.' Small doses of physic, the administration of the white antimonial powder, the use of stimulating embrocations, with warm lodging and good food, especially mashes, will be useful adjuvants.

"As for that species of nervous affection *rabies* or *madness*, it admits not of cure; and it has but one cause, namely, the bite of a rabid or mad dog. If a farmer knows that certain beasts have been bitten, or has strong reason to suspect it, he will act wisely in sending them to the butcher, for after the disease has once appeared there is no cure, and the meat is spoiled.

"It is time to recur to the diseases of other systems and parts. Too frequent and destructive is that inflammation of the tongue and mouth recognised by the name of *blain*; it consists of vesicles and tumours occupying the side of the tongue and the membrane of the mouth, speedily ulcerating, becoming gangrenous, producing much swelling of the face and head, and rapidly destroying the animal. It often appears under the form of an epidemic, and it is frequently contagious. The mouth should be well cleansed with a solution of the chloride of lime. Blood should be abstracted in an early period of the disease, and mild purgatives administered; but if the complaint has attained its height before any treatment is adopted, the chloride of lime should still be used, and also the physic, but it should be accompanied by some stimulating ingredients, as gentian or ginger, or both.

"All cattle are subject to *fever*; the dry muzzle, and the heat at the root of the horn, and the heaving at the flanks, are sufficient proofs of it. If this is early observed, a dose of physic and one or two mashes will usually set all right. At times, however, the attack is sudden and more violent, and danger is evident from the very commencement. The farmer recognises this affection by the terms *black-quarter*, *quarter-ill*, *blood-striking*, &c.; the beast is seen with his head protruded, his nostrils expanded, and his flank heaving, the breath and horn hot, and the eyes bloodshot; there is a peculiar crackling sound if the loins are pressed upon, and the slightest pressure gives extreme pain; ulcers appear on various parts of the body, and every part seems tending to corruption. This disease is sometimes epidemic, but it is quite as often the consequence of the fattening process being hurried on too rapidly. In the early stage of such a complaint the treatment will consist of copious bleeding and brisk purging; these should be continued until they produce their effect, and then some sedative medicine, as foxglove, or emetic tartar, administered and persisted in until the disease is evidently yielding. After this, some mild stomachics, as gentian and ginger, should be administered.

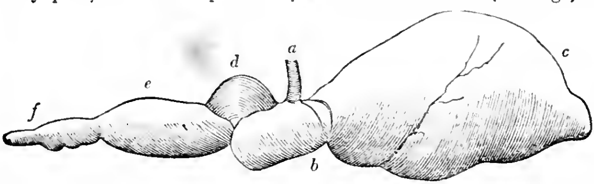
"Too frequently, however, the treatment has not been sufficiently active, or was not commenced early enough, and a peculiar low fever begins to be apparent. There is dysentery, which no astringent will arrest; ulcers, which defy the power of every disinfectant; and the animal dies one mass of putridity. In this stage of the disease, and also in many of the complaints that have been described, the assistance of an educated veterinary surgeon should be requested, for the treatment is complicated and difficult to a great degree.

"The diseases of the respiratory system require particular notice: most frequent among them is *cough*. It is too little regarded by the owner, but it is often the unsuspected messenger of consumption and death. There is no rule of more universal application in cattle practice than that a chronic cough is the forerunner of everything that is bad. While the beast feeds well, and the muzzle is cool and moist, and the flanks are quiet, the dairyman feels no alarm, although he hears the cough almost every time that he enters the cow-house. By-and-by, however, he finds that the cow is losing condition, and her quantity of milk is evidently diminishing, and he begins to think that there is some necessity for attending to the case. It is then too late; the seeds of consumption are sown, and he must part with her immediately, or she will pine away and die. In every case of severe cough, moderate bleeding and purgation should be had recourse to, with warm mashes and a comfortable cow-house. The same treatment will apply to the *epidemic catarrh*, which is sometimes so prevalent. When this catarrh assumes a malignant form, as in *murrain*, the treatment will be little different from that of black-quarter. *Sore throat*, or inflammation of the upper part of the throat and the back of the mouth, should be treated as cough, except that a blister or some stimulating application should be had recourse to. The same may be said of *bronchitis*, but there is a peculiar form of it to which young cattle are subject, and which bids defiance to all medical treatment, namely, the choking of the windpipe and passages of the lungs by an innumerable host of minute worms. No medicine will be of avail here.

"Cattle are comparatively seldom attacked by pure *inflammation of the lungs*; this disease principally occurs when the beasts have been compelled to travel too far or too fast, and when they are exposed to sudden variations of temperature. It may be known by the drooping head, the heaving flank, the frequent painful cough, the obstinate standing, the hot mouth, and the cold feet. The animal should immediately be bled until the pulse falters. In all cases of inflammation and danger, this is the guide. No specific quantity should be ordered or taken. The faltering of the pulse is the unerring indication of the abstraction of the proper quantity. If the pulse again throbs hardly, the bleeding should be repeated. The bowels should be opened by means of Epsom salts. Setons in the dewlap should not be forgotten, and blisters should be rubbed on the sides with right good earnest. The diet should consist of thin gruel and mashes. *Pleurisy* may often be distinguished by a peculiar symptom, twitchings and shiverings about the chest and shoulders, these being the parts external to the seat of pain. Little waves appear to be stealing over the skin, and the animal shrinks when the sides are pressed upon. The treatment is the same as in inflammation of the lungs. *Consumption* is the most frequent and fatal of all the diseases of the chest in cattle; it is the consequence or the winding up of every other pulmonary complaint. It is distinguished by a feeble and hoarse cough, evidently accompanied by pain, and interrupted before it is perfectly completed; for a while the beast may continue to thrive; she—for it is oftenest a disease of the female—may increase in condition; but she will presently begin to waste rapidly away. Medicine is powerless in this disease. The animal must be disposed of or destroyed.

"First among the diseases of the *digestive* system is *choking*, or the stopping of a piece of carrot or turnip, or other hard substance, in its passage down the gullet. The cart-rope or the cart-whip is resorted to in order to force it along the canal, and much mischief has ensued from the violence that has been resorted to on these occasions. Probangs are now constructed at trifling expense, and may be had from most surgical-instrument makers in town and country, by means of which the purpose may be readily effected, and without danger. See *Probang*.

"From the gullet the food passes into the stomachs of the animal, of which there are four (see *Fig.*). The



a, the gullet. *b*, the paunch. *c*, the honeycomb. *d*, the manyplies. *e*, the reed. *f*, the commencement of the duodenum.

first is the *rumen*, or paunch, into which the imperfectly-masticated food, as it is hastily gathered, descends; it is there macerated and prepared to be returned for a second or more complete grinding. Sometimes this stomach becomes overloaded with food: this is the *grain side* of the dairy. The animal refuses to eat, he becomes uneasy, moans, swells at the flank, and a kind of unconsciousness gradually steals upon him. The symptoms are often treacherous, and would deceive him who was not thoroughly acquainted with the diseases of cattle; but the introduction of the probang, if necessary, will reveal the real state of the case. The stomach-pump will be of admirable use here. Any quantity of fluid can be injected into the stomach, and the hardened mass may be rendered more fluid, and removed by means of the pump; or, if the stomach is too full to admit the probang, and to be thus evacuated, an incision may be made in the flank, and the accumulated mass withdrawn by the hand.

"At other times an unnatural fermentation commences, and the stomach is inflated with gas. One look at the sides will sufficiently indicate the inflation of the paunch; this is termed *hoove.* The first indication of cure is to get rid of the gas; this may be accomplished by the introduction of substances that will chemically combine with it: the chloride of lime will effect this. The principal gas in the inflated stomach is a compound of hydrogen. The chlorine leaves the lime and combines with the hydrogen, and the compound does not occupy a thousandth part of the space previously occupied by the hydrogen. Two drachms of the chloride of lime will form a cheap and a very efficient agent; but if this is not at hand, then a puncture may be made into the left flank with perfect safety. If this is done with a trocar, the canula may remain in the wound, and the gas will continue to be extricated while any considerable portion of it remains. In default of a trocar, a penknife may be used; but as the upper portion of the stomach sinks with the disengagement of the gas, the aperture through the skin and that into the rumen will cease to be accurately opposed to each other, and some of the gas and the contents of the stomach will enter the cavity of the abdomen, and will be the cause of future illness, or, perchance, of death.

"The gas having escaped, a purgative should be administered, with a double dose of the aromatic, in order to excite the stomach to resume its duty. Hoove, or hoven, is to be avoided by not letting cattle get at too much green food in spring.

"The *loss of cud*, or the cessation of rumination, is only the indication or the consequence of other disease, and will cease with it. If the nature of that disease is not clear, a dose of physic, with the usual or more than the usual quantity of the carminative, may be given.

"The diseases of the second stomach, the *reticulum*, or *honeycomb*, are few, and not easily distinguished: the simple function of that stomach is to prepare the pellet of food for remastication.

"The third stomach, the *manyplies*, has more to do. The food which has not undergone sufficient comminution in the second mastication is seized by the rough and powerful leaves of this stomach, and is ground down, as it were, in a living mill. Sometimes, however, there is a deficiency of moisture in this stomach, or the muscular apparatus of the leaves does not act with sufficient energy; and at length the manyplie becomes perfectly paralyzed by the distention caused in consequence of the undue quantity of food which is accumulated in it: this is known by the name of *fardel-bound.* The symptoms are not always evident. Dulness, want of appetite, disinclination to move, and costiveness, are among the usual indications. The treatment is simple, but too often ineffectual. It consists in the frequent administration of small doses of purgative medicine, with more than the usual quantity of carminatives; at the same time, a small stream of warm water is, by means of a horn or the stomach-pump, made to flow down the gullet and pass through the canal at the base of this stomach, thus gradually dislodging and washing away a portion of the accumulated and hardened contents.

"The principal disease of the *abomasum*, or fourth stomach, is inflammation, designated by evident uneasiness, the resting of the muzzle on the situation of this stomach, or a peculiar stretching out of the fore legs. Venesection and purgatives should be used in this case. Of the indications of disease in the *spleen*, little is known; inflammation is often found in it, with enlargement, induration, or softening of its substance. These circumstances, however, are rarely suspected during life.

"To *diseases of the liver* these animals appear to be peculiarly prone. A yellowness of the skin betrays the existence of biliary affections in a great proportion of the inhabitants of every dairy. When acute inflammation of the liver exists to any considerable extent, not only this yellow tint of the integument will be found, but tenderness on the right side, fulness there, and the direction of the muzzle to it. The proper remedies are those used in inflammation of other viscera, with the addition of blisters over the diseased part. Chronic inflammation is far more prevalent than that which is acute. The indications are, want of condition, the same tint of the skin, and obstinate cough. The remedies are gentle purgatives, and succulent food. When obstruction of the biliary ducts takes place, there is a still deeper yellow, invariably accompanied by loss of condition. The animal then has *jaundice*, or the *yellows*. If much fever accompanies it, recourse must be had to bleeding and to physic. Cattle in swampy places nearly always have disease of the liver, and even die of bilious fevers.

"Among the various intestinal diseases of the ox stands *enteritis*, or inflammation involving all the coats of the intestines. Young and fattening cattle are most subject to it. It is not, however, of very frequent occurrence, except as an epidemic, and then it is very destructive. *Wood-evil* and *moor-ill* are varieties of the same disease. They must be treated by bleeding, demulcents, blisters on the belly, mashes, and gruel.

"*Diarrhœa*, or purging without the discharge of mucus mingling with the fæces, is produced by various causes, and particularly by a change or excess of food. It is often epidemic in the autumn. A mild purgative should first be given, and then the mingled, but very efficacious medicine already recommended for a similar disease in calves.

"*Dysentery*, in the adult as well as in the young animal, is, indeed, a fearful disease. Its causes are often obscure, and the means of successfully arresting its progress are a desideratum. Its principal characteristic is the discharge of mucus with the fæces, recognised by the appearance of bubbles standing for a while on the fæces. The length of time which they continue there unbroken may be considered as a kind of admeasurement of the quantity of mucus actually discharged, or, in other words, of the danger of the case. The progress of the disease is rapid or slow, according to circumstances which it is difficult to appreciate; but, in the usual course of things, the animal wastes away almost to a skeleton, and then dies.

"Notwithstanding the purging, the first indication of cure is to bleed. It is an inflammatory disease, and that inflammation must be subdued. To the abstraction of blood should succeed the administration of an aperient; and castor oil, as being the least irritative, will be the best. Injections of gruel should follow; and when the dung has somewhat resumed its natural character, astringents may be administered, at the very head of which, in this case, stands opium: a little calomel should, perhaps, be mingled with it, as an alterative; and after that the vegetable tonics must perfect the cure. Cattle are subject to *flatulent* and *spasmodic colic*, for both of which the vegetable tonics will be the best cure, with a little of the chloride of lime to absorb the gas, and the abstraction of blood if there is any inflammatory action. Walking exercise and friction of the belly should not be omitted. For *strangulation* of the intestines there is seldom any cure but by means of an operation, which a skilful veterinary surgeon alone can perform. In cases of *constipation*, the aperients must sometimes be long administered before the bowels will be opened. There will be no danger in this, provided the Epsom salts, alone or with a small portion of aromatic powder, are administered. *Dropsy* in cattle seldom admits of cure. Although an operation may be resorted to, the belly fills again, nor will any physic or diuretic arrest the evil.

"Among the supposed diseases of the urinary organs, but much oftener of the digestive ones, stands *red-water*, so called from the colour of the fluid which is evacuated. It is materially connected with the pasture, but sometimes it has an epidemic character. In the acute form of the disease the water is red. This must be combated by bleeding and purging until the bowels respond. In chronic red-water, the urine has a brown tinge at first, but a red hue gradually mingles with it. This is difficult to treat. The principal hope of cure consists in the exhibition of Epsom salts until thorough purging is produced. Some mild carminative may then be given. *Black-water* is only a variety, or the concluding stage of red-water.

"*Puerperal fever*, or dropping after calving, is a disease that has been very much misunderstood. A few days after calving, the cow suddenly loses all power over her hind limbs. She falls, and continues down three, four, or more days, until the power of voluntary motion returns, or she dies It is inflammation of the womb or of the spinal cord, which extends to the organs of motion in the hind extremities. She must generally be bled, and always purged. No half measures will do here ; the bowels being once opened, the cow will frequently get up, and there will be an end of the matter. Injections will materially assist the action of the physic. Whatever apparent weakness there may be, no tonic must be given until the bowels have been well opened.

"*Garget* is inflammation or ulceration of the udder. The milk coagulates in the bag, and produces inflammation there. In an early stage, the sucking of the calf will afford the greatest relief. If this does not succeed, fomentation must be had recourse to, and friction with an unguent composed of elder ointment, with an eighth part of camphor, and mercurial ointment. To this, if necessary, iodine may succeed ; but it must be a last resource, on account of its absorbent power.

"The treatment of *cowpox* will consist in fomenting the teats, applying an emollient ointment, and giving a little physic.

"The diseases of the feet must not be forgotten. *Foul in the foot* consists in ulceration about the coronet or between the claws, which produces great lameness, and occasionally loss of the hoof. It is very contagious. The treatment is simple : every pustule or collection of purulent matter must be opened ; the horn which is separated from the parts beneath must be carefully and wholly removed ; a linseed-meal poultice applied for a day or two, and then the sores touched with the *butter of antimony*.

"*Mange* is a too frequent and very troublesome disease among cattle. An ointment, however, the basis of which is sulphur, with a small portion of mercurial ointment, daily and well rubbed on every affected part, will usually remove the complaint. Sulphur given internally will be a useful adjunct."—(*Youatt.*)

For the medicines and their doses, see the article *Pharmacopœia*.

OXALATES. Salts of oxalic acid.

OXALIC ACID. See *Acids*.

OXALIS. The genus of wood sorrels. "The *O. crenata* is a perennial, ornamental plant, native of Chili. The flowers are beautiful, of a yellow colour, and in umbels ; the stalks and leaves are succulent, of an acid taste, and useful as salads ; the roots or tubes are produced in clusters ; their taste, when boiled, somewhat resembles a chestnut. They are raised from the tubers, are very productive, as easily cultivated as the potato, and decidedly superior in flavour. They require a rich soil, and, like the potato, are stored during winter in cellars."—(*Kenrick.*)

OXAMIDE. A white, insoluble sublimate, rising in a dense vapour when oxalate of ammonia is decomposed by heat ; formula, $N\ H_2\ C_2\ O_2$. It is a test of the goodness of African guano.

OX BOOSE. A stall for oxen.

OXEN IN THE WEST. The abundance of cattle sustained by the prairies, and their cheapness, has led to the introduction of various plans for disposing of the carcasses. See *Ellsworth's Report*, 1844.

The hide is salted for the English market, and netts four to five cents the pound. The hoofs and horns are similarly disposed of. From the thigh and shoulder. 75 to 100 lbs. of lean, fit for drying into jugged beef, are obtained; 100 lbs. of the best pieces are also salted for shipping. The liver is rubbed with nitre, and salted for home consumption.

But the great object is to obtain the tallow. For this, the rest of the carcass is cut up, and placed in an iron cylinder holding 10,000 to 15,000 lbs. The top is made fast, and steam let in at 70 lbs. pressure, equal to 306° Fahr. In 12 to 14 hours the grease will be free, and may be drawn off into barrels. The soup formed under the tallow is used, with meal, &c., to fatten hogs. 40 oxen per day will feed 600 to 1000 hogs. The pigs, in time, are steamed into lard.

An ox of 700 lbs. yields 25 lbs. suet from kidneys, 50 lbs. from intestines, 100 lbs. hide, 100 lean meat, and the rest yields 10 to 20 per cent. tallow, from a fat animal.

It is to be remarked that the fat is not equal to that taken without steaming. The bones, burned into boneblack, form a rich manure and excellent purifying substance for sugar refiners. They are also assorted for buttons, knife handles, &c., and the rest exported for manure.

OX EYE. The genus *Chrysanthemum*. Weeds growing among wheat and small grain, with large white and yellow composite flowers.

OX FEET. When the horse's hoof splits before. so as to become apparently divided into two parts.

OX GALL, or BILE. It is an excellent substance to refresh the colour of old, greasy carpets. For this purpose, a small quantity is mixed with water, and the carpet or cloth well brushed with it. The dry gall is very purgative.

OX GANG. An old, uncertain measure of land, varying from 6 to 40 acres.

OX HARROW. A large, heavy harrow.

OXICHLORIDES. Compounds of chlorine with metallic oxides, as bleaching salt.

OXIDATION, OXIDIZING. The act of combining with oxygen, usually that of the air.

OXIDE. A compound of oxygen, with an element or other compound. Numerous oxides are, however, called acids, when they become sour, or are capable of neutralizing alkalies. The most powerful oxides are protoxides; and these are bases. A protoxide contains one equivalent of oxygen; a binoxide or deutoxide, two equivalents; a sesquioxide, three, with two equivalents of the base; a tritoxide or teroxide, three equivalents of oxygen; a quadroxide, four equivalents; and a peroxide represents the highest state of oxidation, which varies much with different bodies. A dioxide is a compound of one equivalent oxygen with two of base.

OXYGEN, VITAL AIR (from *οξυς*, and *γενναειν, to generate*). This important element was discovered in 1774 by Dr. Priestley. There are several compounds of oxygen which, when exposed to heat, are decomposed, and yield the gas in a state of purity. Of these, the best is chlorate of potash; but as that salt is expensive, we generally resort to black oxide of manganese, which, at a dull-red heat, gives out a considerable quantity of tolerably pure oxygen gas.

Oxygen gas is colourless, tasteless, and inodorous; it is electronegative, and therefore, when compounds containing it are electrically decomposed, it always appears at the positive surface. It is a little heavier than atmospheric air, in the proportion of 11 to 10; 100 cubic inches weighing 34·18 grains. Its equivalent is 8 on the hydrogen scale, but it is often made the 100th of what is called the oxygen scale, symbol O. It is absorbed by water to the extent of less than one per cent., and is neither acid nor alkaline. It has a powerful attraction for most of the simple substances, especially for the electropositive bodies. The act of combining with it is called oxidation. The compounds thus formed are divided into acids and oxides; among the latter are the alkalies, and almost all salifiable bases. Oxidation is often attended with the evolution of heat and light, as in all processes of combustion in atmospheric air; sometimes it is slow, and unattended with such phenomena, as in the gradual rusting of metals. Oxygen is a most powerful supporter of combustion; it constitutes one fifth of the bulk of the atmosphere, and is the principle which enables combustible bodies to burn in it. The product of combustion, that is, the oxide or acid, is sometimes itself gaseous, as when charcoal, by burning, is converted into carbonic acid; or it is liquid, as hydrogen, by combustion, produces water; or it is solid, as when iron, by burning, produces oxide of iron. Oxygen gas is also essential to respiration; that is, to the evolution of carbonic acid from the blood; but requires to be diluted with nitrogen, as in the air, otherwise it destroys life by producing over-activity. Seeds cannot germinate without oxygen, and are, therefore, not to be buried too deep in a compact soil. The leaves of trees, also, cannot perform their functions without its presence, although they are always exhaling a large quantity of this gas. Oxygen is very extensively diffused in nature; in the compound state it forms eight ninths of all waters, and at least one half of all structures, whether mineral or organic, except a few oils and resins.

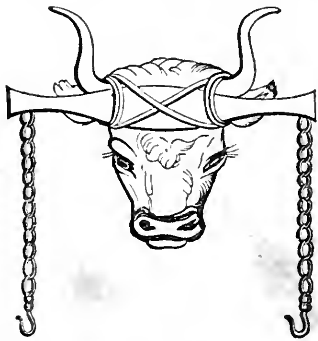
OXYGENATION, AERATION. The introduction of atmospheric air into the blood through respiration.

OXYHYDROGEN BLOWPIPE. A contrivance for burning hydrogen gas in an atmosphere of pure oxygen, whereby the most intense heat is obtained. Dr. Hare's apparatus is considered equal, if not superior, to most others.

OXYMEL. A mixture of honey and vinegar, for coughs.

OXYMURIATES, OXYCHLORIDES. An erroneous name for salts of chlorine, formerly called oxymuriatic acid.

OX-YOKE. The timber placed above the heads of oxen, and fastened by a throat-latch or pieee, to yoke them. The French fasten a flat board to the foreheads; and it is fonnd best to have one for each ox, as shown in the *Figure*. Harness-



ing oxen in the same way as horses, if they be well broken, is a very superior method, and highly recommended in hilly countries, where it has been practised from time unknown, as in Wales, Cornwall, and Devonshire in England.

OXY-SALTS. Chemical compounds containing an acid and alkali, which are both oxides. This class of salts comprehends the greater part of those used in the arts.

OXYURES. A family of hymenopterous insects with an external ovipositor resembling a tail. They are pupivorous, and prey on other insects. A genus of intestinal worms, also.

OYSTERS. *Ostracea*. A family of inequivalve bivalves, of which the *Ostrea edulis*, or common oyster, is an esteemed luxury. Those from the Chesapeake Bay are best. They are frequently transplanted and set in beds in the North and East Rivers, and elsewhere, divided by stakes, in shallow water, within reach of the tide: water which is only partially salt is best. They grow sufficiently for use in two or three years. They should not be disturbed in May, which is the spawning season, but are fit to eat in August.

OYSTER SHELLS. They consist, according to Brandes, of one half per cent. matter resembling glue, 98·3 carbonate of lime, and 1·2 per cent. of phosphate and sulphate of lime. They are, therefore, a manure resembling chalk, when ground into powder, and have been used with good effects on wheat and leguminous crops. They can be crushed with a common bark mill. When burned in an open kiln, the animal matter is driven off, and the best description of lime is formed. These remarks apply to all shells which are not *porcelanous*.

OZŒNA (from οζω, *I smell*). A putrid discharge from the nose.

P.

PACANE-NUT. The Louisiana hickory. The nut is the best of the hickory kind.

PACE. A distance of from four to five feet.

PACHYDERMATA (from παχυς, *thick*, and δερμα, *skin*). The order of quadrupeds with thick hides, as the horse, elephant, oxen, pig, &c.

PACING, AMBLING. A natural pace of the horse, in which both legs of one side are raised.

PADDLE STAFF. A staff or implement used to free the ploughshare from earth, &c.

PADDOCK. A small enclosure at pasture.

PAGINA. The flat surface of the leaf.

PAGODITE. A kind of steatite.

PALATE. The roof of the mouth. It is divided into hard or bony palate, and soft palate, the latter being the membrane at the innermost portion. The shape and markings of the palate are adduced by zoologists in their descriptions. The elevated portion of the lower lip of a personate flower.

PALEÆ, CHAFF. A name given to the bracts that are stationed upon the receptacle of compositæ between the florets, and having generally a membranous texture and no colour; also the interior bracts of the flowers of grasses.

PALINGS. Light fences made by driving posts at distances of ten or twelve feet into the soil, crossing them above and below by stout timbers, and nailing slabs or laths of wood to these in an upright direction, and at intervals of three or four inches.

PALLADIUM. A rare metal, resembling platinum: sp. gr., 11·8.

PALMA CHRISTI. The castor oil plant, which see.

PALMATE. Resembling the hand, five-lobed or toothed.

PALMETTO. *Chamærops palmetto.* A cabbage-tree palm, growing as far north as 34° N. lat. It sometimes rises ninety feet; the stem is nearly cylindrical, capped by a splendid frond, the centre of which, an immense bud, is tender, and can be eaten as a vegetable, but its removal destroys the tree. Like other palms, the outside of the trunks is very hard and durable, and the interior spongy. The hollowed stems make good tubes to convey water, or, being split in halves, they serve for piles, and last a long time in water. The fully-expanded leaf is very large; fans, hats, and a good thatch may be made from it. The fruit is like a date, not very palatable. The genus *Chamærops* contains also the indigenous species *serrulata* and *hystrix*, with creeping stems, and which, when burned, are said to yield a large amount of potashes.

PALMIPEDES. The anseres, or swimming birds of Linnæus.

PALM OIL. The solid, fragrant oil of the *Avoira elais*, an African palm-tree

PALMS, PALMACEÆ. A natural order of arborescent endogens, like the palmetto, chiefly inhabiting the tropics, distinguished by their fleshy, colourless, six-parted flowers, enclosed within spathes, and rigid plaited or pinnate inarticulated leaves, sometimes called fronds. They yield bread, oil, wine, cordage, fuel, and all necessaries to the savages of the tropics.

PALP, PALPUS. The jointed organs attached to the labium and maxilla of insects: the feelers.

PALPATORS. Those clavicorn beetles with long palpi.

PALSY. Loss of nervous power, in horses, usually in the hind legs. See the *Horse*, *Ox*, *Sheep*.

PALUSTRINE, PALUSTRIS. Marshy, belonging to a marsh.

PAMBINA. A species of high cranberry, found near the Columbia River.

PAMPAS. The South American prairies.

PAN. A term applied to the bed or flooring upon which the cultivated soil lies or is placed. It is sometime extremely hard. See *Moor*.

PANACEA. A universal and fabulous remedy.

PANCREAS. The sweet bread. It is composed of innumerable small glands, the excretory ducts of which unite and form one duct, called the pancreatic duct, that conveys a fluid very similar to saliva into the intestines, called the pancreatic juice, which mixes with the chyle in the duodenum.

PANE OF GROUND. A small, four-sided piece of ground capable of irrigation.

PANDURIFORM. Shaped like a fiddle or guitar.

PAN-FEEDERS. In horticulture, the shallow vessels in which pots are set.

PANIC GRASS. The genus *Panicum*. Coarse annuals, of little value for grass. *P. miliaceum* is one variety of millet, which see.

PANICLE. A kind of inflorescence, in which the central stalk throws out lateral stems, and these bear the petioled flowers, as in oats.

PANNAGE. The food consumed by hogs in woods.

PANSY. Heart's ease. Violets.

PAPAVERACEÆ. Plants allied to the poppies; they are for the most part narcotics.

PAPAW. *Carica papaya*, *Assiminier*. A Southwestern tree, attaining sometimes twenty-five feet; the fruit is three inches long, soft and insipid; a spirituous liquor may be made from it: the wood is useless.

PAPILIONACEÆ, PAPILIONACEOUS PLANTS. The *Leguminosæ*.

PAPILIONACEOUS FLOWERS. A name given to the corolla of leguminous plants, as that of the garden pea and bean; it consists of a large upper petal, standard, or *vexillum*; two lateral petals, called *alæ*, wings; and two intermediate petals, forming the keel, or *carina*.

PAPILIONIDÆ. Lepidopterous insects, properly called butterflies: they feed by day.

PAPILLA, PAPILLÆ. Small delicate eminences, as on the tongue.

PAPPUS. The hairy down of thistles and other compositæ. *Pappose* is a derivative.

PAPYRUS. A large sedge (*Cyperus papyrus*), a native of the Nile and Southern Asia, from which the ancients made their paper, or papyrus.

PARACENTESIS. Tapping, opening the covering of the abdomen, &c., to let out water: it is done with a trocar.

PARACYANOGEN. A brown solid, with the composition of cyanogen.

PARADOX. An apparent absurdity, but really a fact.

PARAFINE. A tasteless, inodorous, fatty matter, obtained, among the products of distillation, from wood tar.

PARAGUAY TEA. *Ilex Paraguayensis*. An evergreen holly, the leaves of which contain *theine*, and are used as tea in South America. It grows well in Georgia.

PARALYSIS. Palsy. *Paralytic* is a derivative.

PARAPLEGIA. Paralysis of the upper or lower part of the body only.

PARASITE, PARASITIC PLANTS. Plants which strike their roots into the textures of others, as the misletoe: mildew, smut, rust, &c., are also parasites. Many insects are parasitical on animals.

PARASTATE. Square pillars standing from the wall.

PARCHMENT. Refuse or clippings make glue, or sizing, when boiled; they constitute an excellent manure of the same kind as woollen rags.

PAREGORIC. Tincture of opium

and camphor with oil of anise seed; an anodyne to allay pain.

PARELLA. *Lecanora parella.* A lichen of Europe, used as a dye, and similar to archil.

PARENCHYMA. The cellular substance of vegetables or animals.

PARGASITE. A kind of hornblend (*actinolyte*).

PARGET. The plaster of lime, hair, cow dung, and water used in coating the flue of a chimney.

PARHELION. The appearance of two or more suns from the misty state of the air. *Paraselenæ* are several moons seen from the same cause.

PARIETAL. In botany, any organ which grows from the sides of another is said to be parietal. The parietal bones, in zoology, are those at the sides of the skull, which together form the arch.

PARING AND BURNING. "This operation consists in cutting a thin slice from the surface of land which is overgrown with grass, heath, fern, or any other plants which form a sward by the matting together of their roots. The sods are allowed to dry in the sun to a certain degree, after which they are arranged in heaps, and burned slowly, without flame or violent heat. The result is a mixture of burned earth, charred vegetable fibre, and the ashes of that part which is entirely consumed.

"The object of this operation is twofold: first, to kill insects and destroy useless or noxious weeds completely; and, secondly, to obtain a powerful manure, impregnated with alkaline salts and carbonaceous matter, which experience has shown to be a very powerful promoter of vegetation.

"The instruments by which this is effected are either a common plough with a very flat share, which may be used when the surface is very level without being encumbered with stone or large roots, as in low moist meadows, or, in most other cases, a paring-iron, which is used by hand. The cross-bar of this instrument is held with both hands, and the upper parts of the thighs, being protected by two small slips of board, push the instrument into the ground, so as to cut a slice of the required thickness, which is then turned over by moving the cross-handle. The labour is severe, and a good workman can scarcely pare more than one sixth of an acre in a day.

"Paring and burning the surface is an almost invariable preliminary in the converting of waste lands to tillage; and where these lands are in a state of nature, overrun with wild plants which cannot be easily brought to decay by simply burying them in the ground, burning is the readiest and most effectual mode of destroying them. In this case the practice is universally recommended and approved of.

"But it is not only in the reclaiming of waste lands, and bringing them into cultivation, that paring and burning the surface is practised. The fertility produced by the ashes, which is proved by the luxuriance of the vegetation in the first crop, has induced many to repeat this process so often as materially to exhaust the soil, and induce partial sterility. Hence the practice has been recommended on the one hand and strongly reprobated on the other.

"When we come to apply to the subject the test of experience, and reason correctly on the facts which are presented to us by the abettors of the practice and its adversaries, we shall find that the advantages and disadvantages arise chiefly from the circumstances under which the operation is carried on. But it may be necessary to an impartial examination of the subject, to inquire into the changes produced on the substances subjected to the process of burning, when it is done with due precautions.

"In burning vegetable matter in an open fire, the whole of the carbon is converted into carbonic acid and flies off, leaving only some light ashes, containing the earthy matter and the salts which the fire could not dissipate. These are, no doubt, very powerful agents in promoting vegetation, when they are added to any soil; but they are obtained at a very great expense of vegetable matter, which, by its decomposition in the earth, might also have afforded food for vegetation. If the earth which is burned with the sods is of a cold, clayey nature, the fire will change it into a kind of sand, or brickdust, which is insoluble in water, and corrects the too great tenacity of clays, by converting them more or less into loams. This is so well known, that clay is often dug out of the subsoil to be partially burned. On stiff clay soils, therefore, there is a double advantage in paring and burning, that of the vegetable ashes and of the burned clay. When the fire is so managed that the vegetable matter is only partially burned, the oily and inflammable portions being converted into vapour by the fire without being destroyed, and absorbed by the earth, the effect produced is only to impregnate the earth with minute particles of matter, readily converted into the constituent parts of vegetables. The earth is the mere recipient of these particles, which are held in its pores, as water is in a sponge, ready to be let loose to any substance which has the power of attracting them. The moisture, which the dry earth will also absorb from the atmosphere if no rain should fall, is retained and increased by the effect of the salts with which it is impregnated.

"The principal objection to burning is, that it destroys a great portion of vegetable matter. But this is a fact to be proved, and is, perhaps, rashly taken for granted. It appears that a clay soil may be pared and burned without its real substance being diminished; and if its texture is improved, it becomes more fertile by the operation.

"Many experienced farmers pare and burn the soil on the edges of their ditches and on the banks on which the hedges grow, because they thereby exterminate many rank weeds; and the burned earth mixed with farm-yard dung makes an admirable compost. Here the burned earth acts as an absorbent, and no doubt attracts many of the volatile parts of the manure, which are produced by the decomposition of animal and vegetable matter in it. Paring and burning, therefore, should be joined to manuring, if a powerful and immediate effect is desired without exhausting the soil; and, in this case, we do not hesitate to recommend it on all cold clay soils, where rank weeds are apt to spring up, and coarse grasses take the place of the better sorts which have been sown. The proper time to pare and burn is evidently after the land has lain in grass for several years, and is broken up for tillage. The surface should be pared thin; about two inches is the extreme thickness allowable for the sod if the soil is very stiff and poor, and as thin as possible in a better soil. The sods should be moderately dried, and then arranged into small heaps with a hollow in the middle to hold heath or bushes to kindle the fire. When it has fairly established itself, all the apertures should be carefully closed. Wherever any smoke breaks out, a fresh sod should be immediately put over it; a heap containing a small cart-load of sods should be smouldering for several days without going out, even if it rains hard. If the fire is too brisk, the earth will form hard lumps, and even vitrify; but otherwise it comes out in the form of a fine powder, in which evident marks of charcoal appear. If this is of a fine red colour, it is a good sign; for the iron in the earth has been converted into a peroxide, which is perfectly innocent in its effects on vegetation, whereas all the saline impregnations of iron are more or less hurtful. It is better to burn the sods in large than in small heaps; for the more the fire is smothered the better the ashes.

"So great a quantity of ashes is sometimes produced as to admit of a portion being carried off on grass land, or used to manure another field. As this is evidently robbing the field where the operation has been carried on, an equivalent quantity of manure should be brought in exchange. Perhaps the most advantageous mode of using the ashes is to spread them in the drills where the seed is to be sown, after a portion of dung has been buried under them. In this manner the ashes from one acre of land pared and burned, together with ten or twelve cart-loads of good yard dung, will manure two acres. But experience proves that the earth and ashes almost ensure a good crop of turnips in many poor, stiff soils, in which they would probably not have succeeded if sown in the common course of cultivation without bones or ashes.

"When a considerable extent of poor land is brought into cultivation, and there is no sufficient supply of manure at hand, paring and burning a portion of the land every year, by which a crop is obtained, is a most effectual means of improvement. Lime may be used at the same time with the ashes, and will increase their effect. It would be a great waste to burn the surface of a rich piece of grass land, where the plants growing in it are tender and succulent, and would readily rot on being ploughed under; in such case a moderate application of lime would have a much better effect. This kind of land will produce good crops without any manure, and continue fertile for many years if judiciously cultivated. To pare and burn rich land is wasteful, and can never be recommended. It is only on poor land which has not strength to produce a crop, and of which the texture requires to be improved and its powers stimulated, that paring and burning is advantageous; on poor, thin, chalky soils, which have been laid down with sainfoin, of which the roots and stems are grown coarse and hard, so as not readily to rot in the ground, the operation is proper and advantageous.

"Many tracts of waste land might be brought into cultivation by means of paring and burning, which without it would never repay the labour required. Where the soil is inclined to peat, this operation and abundant liming are the indispensable preliminaries of cultivation. The ashes and the lime will produce vegetation and food for animals. These will produce dung to supply what the vegetation abstracts, and to assist, also, in the farther decomposition of the peaty matter, converting it into vegetable mould.

"The first crop after paring and burning should, if possible, be turnips, and these should be consumed on the spot; but there are exceptions to the rule. The soil may be a stiff clay of a considerable degree of natural fertility, only encumbered with rank weeds and grasses. In this case the surface is burned to destroy these, and a crop of corn may safely be taken after the paring and burning, the land coming into a regular alternate rotation after it. For example, the next crop may be beans; or clover may be sown with the first crop, if the ground appears fit for it. The effect of the ashes will be readily perceived in the luxuriance of the clover. Such land may be afterward cultivated, according to its nature and quality, with the rest of the farm, or laid down to grass after a course of cleansing and ameliorating crops. Thus old wet meadows, after having been well underdrained, may be greatly improved, and either converted into arable fields, or laid down again with choice grasses.

"Old rough pastures may often be greatly improved by a very thin paring and burning, so as not to destroy all the roots of the grass. When the ashes are spread over the pared surface, some good grass seeds are sown with them. The whole is well harrowed or scarified and rolled, and the grass which will spring up after this will be greatly improved, and will fully repay the expense of this simple mode of renovating it. This is the cheapest mode of improving coarse pastures that we know, without breaking them up.

"The partial paring and burning ot the headlands of fields, for the purpose of mixing the ashes and burned earth with dung in a compost, is a most excellent practice, and often superior to that of using the sods only, without burning them. These sods contain innumerable seeds of weeds, and eggs or maggots of insects, which are not destroyed by the fermentation of the heap, but, on the contrary, are brought to life. The loss of a portion of vegetable matter in the burning is amply compensated by the destruction of these enemies of the future crops.

"It now only remains to take notice of the soils and situations where paring and burning cannot be recommended. Wherever the soil is very loose from a great proportion of silicious sand in its composition, and is held together chiefly by the slender roots which run through it, the burning would destroy the whole of the vegetable matter; for none of the volatile parts which the fire dissipates or generates would be retained or absorbed, but would pass through the loose sand in the same way that water would. Here, then, would be actual destruction; and the residue would be a mere barren silicious sand, much worse and more porous than it was when held together by the roots. The only way to bring such soils into cultivation is to put clay, marl, or vegetable matter on them, and to force vegetation by means of liquid manures, chiefly the urine of animals, consolidating them by every means applicable, so that they may retain moisture, and that the manure may not be washed through by the rains. Such soils may be improved, but they are the most ungrateful of any; and it is only necessity and indefatigable industry which can make them produce any crops.

"It is very easy to ascertain whether any soil will be improved or not by paring and burning. A few sods may be taken and exposed to heat in an iron pot closely covered over, or in a large crucible; the heat should not be so great as to produce light, but should be kept up for a considerable time, till the sods are consumed. If the ashes are red, and the whole is a fine powder, with particles of charcoal in it, the soil from which it was taken may be safely pared and burned, especially if it forms a mud with water, and the earth is not readily deposited. But if it feels gritty, lets the water readily through, and is soon deposited when mixed with it, burning will not be advantageous. This is the evident result of the principles laid down before.

"On the whole, the operation of paring and burning, when judiciously applied and properly performed, is a most excellent and cheap improvement of certain soils, and it will never diminish their fertility, if they are properly cultivated and manured, and a judicious succession of crops is adopted; but, on the contrary, it will improve their quality and texture, and make them more productive."—(*Rham.*)

PARK. An enclosed woodland pasture.

PAROTID GLAND. A large salivary gland, situated at the angle of the jaws.

PAROXYSM. A sharp attack, an increase of sickness.

PARSLEY. *Apium petroselinum.* A biennial, umbelliferous plant, the aromatic leaves of which are much used in cookery. It is propagated readily by seed in a dry, fair soil. The curled variety is the prettiest. A bed once formed will perpetuate itself, if suffered to bear a few seeds annually. It may be covered by straw in the fall to protect it from winter.

PARSLEY, THE HAMBURGH. *Apium latifolium.* This plant is cultivated for its root, which resembles a middling-sized parsnip; it is managed and used in the same way, and is a good vegetable.

PARSLEY, WILD. Wild celery. This and similar umbelliferous plants, growing in wet places, are acrid, and should be carefully weeded out from pastures.

PARSNIP. *Pastinaca sativa.* Varieties: Jersey long, and large Dutch, a well-known umbelliferous plant, cultivated for its roots. It grows well in deep, rich, loamy clay, or sandy soils, and is cultivated exactly like the carrot. Sow in April or May, in drills 18 inches apart, so as to admit the horse hoe, 5 pounds of *fresh* seed per acre; prick out to 12 inches, and hoe well: produce in October 9 to 11 tons; take up with the plough or a fork: they keep well in sand. All stock like them, especially if steamed. The leaves are often given to cows, &c. Its value as fodder will be seen under *Fodder*.

PARSNIP, COW; MASTER WORT. *Heracleum lunatum.* A large perennial, umbelliferous plant, growing in wet places, and very poisonous. Use the stomach pump and warm water in poisoning by it.

PARTERRE. In gardening, a system of beds of different shapes and sizes, in which flowers are cultivated, with intervening spaces, either paved, of gravel, or turf, for walking on.

PARTURITION. The act of bringing forth young.

PASSERINES, PASSERES. "Birds similar to the sparrow, including those which neither manifest the violence of birds of prey, nor have the fixed regimen of the terrestrial birds, but which feed on insects, fruit, or grain, according to the slenderness or strength of their beak; some, with sharp and toothed mandibles, pursue and feed on small birds. All the passerines have short and slender legs, with three toes before and one behind, the two external toes being united by a very short membrane. They form the most extensive and varied order of birds, and are the least readily recognisable by distinctive characters common to the whole group.

"The passerines, in general, have the females smaller and less brilliant in their plumage than the males; they always live in pairs, build in trees, and display the greatest art in the construction of their nests. The young are excluded in a blind and naked state, and wholly depend for subsistence, during a certain period, on parental care. The brain arrives in this order at its greatest proportional size; the organ of voice here attains its utmost complexity; and all the characteristics of the bird, as power of flight, melody of voice, and beauty of plumage, are enjoyed in the highest perfection by one or other of the groups of this extensive and varied order.

"The beak of the passerines varies in form according to the nature of their food, which may be small or young birds, carrion, insects, fruit, seeds, vegetable juices, or of a mixed kind. The modifications of the rostrum have, therefore, afforded convenient characters for the tribes or subdivisions of the order: these are termed, 1. *Dentirosters;* 2. *Conirosters;* 3. *Tenuirosters;* 4. *Fissirosters.*' See those words.

PASSION FLOWER. The genus *Passsiflora*, bearing beautiful flowers, and, in the tropics, tolerable fruit, and a good wood resembling ebony.

PASTEL. A dye stuff, resembling indigo, woad.

PASTERN OF A HORSE. The distance that intervenes between the joint of that name and the coronet of the hoof.

PASTURE LANDS. "Considerable improvements have been made in natural pastures, not only by the raising of banks and stone walls as shelter against the winter's storms, but also by extensive draining and clearing the surface of wild plants and shrubs, which prevent the herbage from springing up, and greatly diminish the feed. On the sides of steep hills, where springs are apt to break out and produce swamps and bogs, drains judiciously made have carried off the water, and laid dry the pastures below them; while reservoirs have been constructed in many places to receive the water and to supply the stock in dry weather. On peaty moors the application of lime to the surface has often produced wonderful effects, and made various kinds of clover and grasses spring up, which were never seen on the spot before.

"Those who are possessed of extensive pastures often look upon them as of too little value to lay out any money in their improvement; and unless when an attempt is made to bring them into regular cultivation, which often fails after a great outlay of money, they are not thought worth attention. Yet many rough, hilly pastures might be doubled and tripled in value, merely by clearing the surface, burning coarse grasses, rushes, ferns, and furze, and sowing a few seeds where the ashes have been spread. The additional number of cattle or sheep which can be maintained by this means would surprise any one who had not had experience of such improvements. The forming of convenient channels for the water to run off is another important object, which can often be effected at a trifling expense ; and a loose surface laid dry by this means may be much improved by merely burning the heath which grows upon it. After the fire has scorched the ground, grasses will spring up spontaneously ; and, at a very small expense, a considerable tract of mountain pasture may be converted from the state of a brown heath, or moor, to that of a fine green sward.

"Wherever there are large pastures, proper and suitable buildings, made of substantial materials, should be erected. The cattle should have numerous sheds for refuge in bad weather, and sheep especially should have protection and shelter. Warmth is in some cases of more importance than food : and an animal exposed to all the severities of a northern climate requires more food to keep him alive than when he is kept warm and protected from the immediate influence of cutting winds.

"To those who have extensive pastures, as on the prairies, it is of great importance to ascertain whether oxen, heifers, cows, or sheep are the most profitable, and of these, what breeds suit the situations ; and, when this has been determined by experience, to know what quantity may safely be kept, without suffering for want of sufficient food, or allowing any portion of the pasture to wither or become coarse from not being duly fed off. Whatever be the stock depastured, the greatest attention should be paid to them by a herdsman or shepherd of experience, who should have a certain number only under his care. It is a good plan to give him some share or interest in the produce as part of his wages. When any part of the stock is sold off to drovers or butchers, he should have a per centage on the sale. This will give him the activity of an owner, and he is not so likely to be negligent and allow the stock to suffer from a want of sufficient food, or from accidents which can be prevented by proper attention.

"When the soil is naturally deep and of a good quality, but the situation renders it not advisable to convert the pastures into permanent arable land, and the herbage has been deteriorated and overrun with moss or weeds, it is a very effective mode of improving the pasture to plough up the sward as thin as possible, and then, having removed the sods into heaps or rows, to plough and scarify the bared surface to the depth of four or five inches, so as to give it the appearance of a fallow field. When it is well pulverized and harrowed level, the sod, which had been taken off, is chopped into small pieces by the spade, and scattered over it ; and after a shower has somewhat moistened the surface, it is well rolled with a heavy roller. Thus the moss is effectually destroyed ; the root weeds have been eradicated, and the fine grasses, the roots of which are short and fibrous, are preserved. They will soon strike into the loosened soil, and a fine close sward will be the result. The improvement is still greater if lime is put on the land before the spreading of the sods, and if, at the same time, some of the best grass seeds are sown over it. The proper season for this operation is after harvest, and no cattle should be admitted till the next spring.

"In the richest pastures, an acre will maintain and fatten an ox of eighty or ninety stone, and sometimes keep several sheep in store order besides. There is a marked difference between land that will fatten an ox, and that which will only rear him. This can scarcely be discovered by simple examination of the land, but is found by experience. The same appearance of grass has more *proof*, as it is called, in one place than another. The bite may be very short and the pasture appear bare, and yet the value of it may be seen on the ribs of the cattle. Much of the skill of a grazier consists in stocking his pastures to advantage. He should know the power of every portion of it, and stock it so that the grass may not grow faster than it can be cropped by the cattle or sheep, and that the animals may always have the full quantity required. Every animal wants a certain quantity of food to repair the daily waste occasioned by the animal functions. If he has no more he makes no progress: the more he can convert into flesh and fat beyond this quantity in a given time, the more profitable he will be. Hence the superior qualities of some animals with respect to this point indicate the superiority of their breed, and afford the greatest nett profit to the grazier. In the same pasture, one beast or sheep will give a reasonable profit, while another may occasion an actual loss. The adaptation of the stock to the nature of the pasture is consequently an object of the greatest importance, and requires much judgment and experience."—(*W. L. Rham.*)

PATELLA. The knee pan.

PATENS, PATENT. Spreading.

PATHOGNOMIC (from *παθος, a disease*, and *γνωμη, opinion*). Symptoms which are characteristic of a disease.

PATHOLOGY. A dissertation on the effects of disease on the body.

PAVILION. "In architecture, a projecting apartment on the flank of a building, usually higher than the rest of it. Summer-houses in gardens are sometimes called by this name, but improperly. The term pavilion is also used to signify a military tent."—(*Brande*).

PAVING ORCHARDS. Sometimes practised about plum-trees to cut off the escape of the curculio. If it is temporary, there can be no objection, but otherwise we are unable to apply composts to the roots. It is very effective against the curculio.

PEA. *Pisum sativum.* An annual of the leguminous family. It is supposed that the gray pea is the *P. arvense.* Varieties:

Early Cedo Nulli, or Race Horse, 3 feet
Early Frame, 2 to 3 feet.
Early Warwick, 3 feet.
Early Washington, 3 feet.
Early Charlton, 3 feet.
Double Blossom Frame, 3 feet.
Bishop's Early Dwarf, 2 feet.
Dwarf Prolific, or Strawberry, 2 feet.
Dwarf Spanish, or Fan, 1 to 2 feet.
Early Nimble Dick, 3 feet.
Dwarf Blue Imperial, 2 to 3 feet.
Waterloo Blue, 4 feet.
Groom's Dwarf Blue Prolific, 4 feet.
Dwarf Blue, Prussian, 2 to 3 feet.
Dwarf Marrowfat, 3 to 4 feet.
Lady's Finger Marrows, 4 feet.
Matchless Marrowfat, 6 feet.
Knight's Tall Marrow, 6 feet.
Knight's Dwarf Marrow, 3 feet.
Woodford's Green Prolific, 6 feet.
Large Gray Rouncival, 4 feet.
Dwarf Sugar (eatable pods), 3 feet.
Tall Crooked Pod Sugar, 6 feet.
French Bouquet, or Sugar, 3 to 4 feet.
Albany Field, several varieties.

The time of sowing is early spring, in drills four to six feet apart; they should be protected by straw, pine brush, or similar substances. A sowing may be made every two weeks until the end of May; a bushel will plant an acre, and yield from fifty to one hundred bushels of green peas. The best soil is a deep, moderately rich, clayey soil, containing some amount of lime, or having been well manured with it. They are usually supported by sticks, but in field culture are allowed to grow on the ground. They should be hoed several times, and earthed up. A fall crop can be obtained in the Middle States by sowing in a shady place after the heat of summer is passing away.

The field is sown broad-cast at two and a half bushels the acre; the crop is readily collected by a short scythe and horse-rake. It should be done while the haulm is of a yellowish green, or the peas scatter. The haulm in this state is a very valuable rough fodder, if carefully housed. The grain is thrashed out, and forms one of the best kinds of provender for all stock and poultry. The yield per acre is from twenty-five to forty bushels.

The pea can be readily forced in the hot-house, and may be much advanced by glass. The diseases of the pea are few: mildew and plant lice sometimes destroy late crops.

Manures. — Like all leguminous plants, pease require lime and gypsum, but as they yield much seed, bone earth is also essential. They are an exhausting crop. The composition of the pea is given by Sprengel: 1000 parts in the ordinary dry state yield

	Seed.	Straw.
Potash and soda	15·50	2·35
Lime and magnesia	1·95	30·70
Phosphoric acid	1·90	2·40
Sulphuric acid	0·52	3·35
Chlorine	0·38	0·00
Silica, iron, &c.	4·40	10·85
	24·65	49·65

PEA BUG. *Bruchus pisi.* A well-known coleopterous insect which lays its egg in the young pea, and comes out in May. Sowing pease two years old, taking care invariably to destroy the insects that are hatched, is a certain preventive.

PEA, COW. Yeatman's pea. A very productive yellow Southern pea, much used for green fallows in the same way as clover.

PEANUT. See *Pindars*.

PEA PATTRIDGE. *Cassia chamæcrista.* Wild sensitive plant. It is a beautiful ornamental plant.

PEACH. *Amygdalus Persica*, of the natural family *Pomaceæ*. The following account is partly from Mr. Thomas:

"The peach is usually cultivated by planting the stone in autumn, at a depth of about two inches; a small part of them grow the succeeding spring, and the remainder the year following. Cracking the stones before planting ensures their growth the first season, but it is best in this case to expose the stones to the action of frost during winter, mixed with sand or earth, and to defer the planting till spring. If the soil be fertile, so that their growth is vigorous, they may be budded the same season; but if not, the operation must be deferred till the second. One and two years' growth of the bud will render them large enough to transplant into the orchard.

"The most suitable soil for the peach is a rich, sandy loam; a light soil is generally preferred, but this is not indispensable, if the ground be well prepared. Peach-trees, when transplanted, should not be large.

"To obtain good varieties with any degree of certainty, budding must be resorted to. Grafting rarely succeeds, and never unless performed with unusual care on such kinds as have the firmest wood. It is an advantage to bud on almond or plum stocks.

"When the great difference between good and bad varieties is remembered, the importance of obtaining the *best* must be obvious. The reputation of some which are excellent has been greatly injured by the numerous errors in names which have been introduced.

"This misapplication of names has induced the attempt to arrange the varieties and distinctive characters, so that this inconvenience may be removed. The peach presents facilities for this purpose not existing in other fruits. The following, which is generally adopted as the best, is from Lindley. Peaches and nectarines (which may be considered as one and the same fruit, the latter having smooth skins) are separated into three general *classes*, each of which has three *divisions*; these are each separated into two *subdivisions*, and every subdivision into two *sections*: consisting, in all, of thirty-six sections. Only a part of these sections contain varieties with which we are acquainted, and are only to be filled up as new ones are discovered with characters adapted to them.

"*Class I.* comprehends those the leaves of which are deeply and doubly serrated, and having no glands on the serratures (*Fig.* 1).

"*Class II.* contains those whose leaves are crenate, and have globose glands (*Fig.* 2).

"*Class III.* includes all those whose leaves are crenate or serrulate, and have kidney-shaped glands (*Fig.* 3).

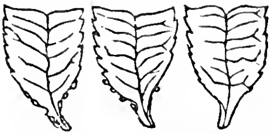


Fig. 3. *Fig.* 2. *Fig.* 1.

"It will, however, sometimes happen that glands are not discernible on some of the leaves, especially on those produced on weak branches; in this case other branches must be sought for which do produce them. They are represented as rather larger and more distinct, in the accompanying figures, than usually occur in a state of nature.

"These classes, thus formed, are each divided into three divisions.

"*Div. I.* embraces those which produce large flowers.

"*Div. II.* includes those which produce flowers of medium size.

"*Div. III.* contains those which produce small flowers.

"These divisions are not so distinctly marked as the classes, the middle and small flowers only differing by the former being larger in all their parts.

The subdivisions, two in number, are determined by the fruit. The first comprehends true *peaches*, or those which have a downy skin; the second includes *nectarines*, or those which have a smooth skin, similar to that of the plum.

"Each of these subdivisions is again divided into two sections; the former including the *pavies*, or clingstones; the latter the *melters*, or freestones.

"The same arrangement may be adopted with the other classes.

"The following list contains some of the best varieties, arranged according to the preceding method:

SERRATED, GLANDLESS LEAVES. LARGE FLOWER.

Peaches—Pavies.

Old Newington.
Early Newington, or Smith's Newington.

Peaches—Melters.

Early Anne. Tillotson.
Malta.
Noblesse.
Early White Nutmeg.

Nectarines—Pavies.

Scarlet Newington.
Tawny Newington.

SERRATED, GLANDLESS LEAVES. SMALL FLOWER.

Peaches—Melters.

Royal George.
Belle de Vitry.

CRENATED LEAVES, WITH GLOBOSE GLANDS. LARGE FLOWER.

Peaches—Melters.

Grosse Mignonne.

CRENATED LEAVES, WITH GLOBOSE GLANDS. SMALL FLOWER.

Peaches—Melters.

Bellegard.
Teton de Venus.
George the Fourth.
President.

CRENATED LEAVES, WITH RENIFORM GLANDS. LARGE FLOWER.

Nectarines—Melters.

Fairchild's.

CRENATED LEAVES, WITH RENIFORM GLANDS. SMALL FLOWER.

Peaches—Pavies.

Incomparable.
Catharine.

Peaches—Melters.

Chancellor.
Late Purple.

Nectarines—Melters.

Common Elruge.
Violet Hative.
Aromatic.

"The following list of peaches will give a constant succession from a period immediately after wheat harvest until autumnal frosts:

	Varieties.	Size.	Ripe.	Remarks.
Melters.	Early White Nutmeg . .	small	July	slender growth.
	Early Anne	middling	August	slender growth.
	Early Tillotson			
	Early Red Rareripe . .	large	August	very productive, excellent.
	Early York	similar		
	Grosse Mignonne . . .	largo	August	very productive, excellent.
	White Imperial	large	August	very productive, excellent.
	Red-cheek Malacaton . .	large	late, August	very productive, excellent.
	Malta	large	August	very productive, splendid.
	Columbia	large	September	very productive, good.
	President	large	September	very productive, good.
Pavies.	Early Newington . . .	middling	August	very productive, good.
	Oldmixon	large	September	very productive, excellent.
	Old Newington	large	September	very productive, excellent.
	Lemon Clingstone, Pineapple, or Kennedy's . .	large	September	very productive, excellent.
	Heath	large	late, September	very productive, excellent.

"The early white nutmeg is a peach of very small size, and a very poor bearer; and a cultivator may count himself fortunate if he gets a quart of peaches from a full-grown tree. It ripens a week or more after our wheat harvests, and is valuable only for its early maturity. The early Anne is later, but much larger and a much better bearer; and were it not for its very slow growth, would be valuable.

"The peach appears to vary more in quality from the effect of climate than other fruits. Culture greatly affects the quality; thus, the Heath clingstone, under favourable circumstances, is an excellent fruit; but if the branches are permitted to bear full, the fruit is small and of little value.

"Peach and nectarine trees are liable to destruction from two causes, the *worm*, and the *yellows*. The presence of the worm is readily detected by the gum, mixed with excrementitious matter, oozing from the trunk, at the surface of the ground. The best, and probably the only effectual remedy is, to scrape the earth from about the tree, and then, with a knife, to follow the holes made by the worm to their termination, and destroy it. As this insect merely confines itself to the *bark*, its destruction is very easy. It rarely occurs that trees are completely destroyed by this insect, except they be small: death can only take place when the bark is eaten round the tree. Timely care will prevent this; the evil, in fact, is only to be dreaded by negligent cultivators."

For an account of the *yellows*, see *Yellows*.

"The shortness of life in the peach-tree, and the consequent difficulty of its culture in some places, appear to be chiefly owing to this disease. In Western New-York it is comparatively unknown, and great care should be used by cultivators that it be not introduced by importations.

"The peach-tree, though generally supposed to be very short-lived, when not destroyed by unnatural causes, will continue to flourish and bear for many years. Trees twenty years old and upward are frequently seen.

"The curled leaf, which frequently appears on peach-trees early in summer, is occasioned by frost or chilly weather. These leaves soon drop, and the tree assumes a healthy appearance. This would not be worth noticing, except that it sometimes occasions unnecessary alarm.

"The growth of some varieties is retarded by mildew on the young shoots. It appears to be exclusively confined to those having serrated, glandless leaves, as the early white nutmeg, early Ann, and some of the earlier varieties of the red rareripe. It is not a very serious evil; and the best remedy appears to be good soil and good culture to stimulate the growth. All yellow-fleshed varieties appear to be entirely free from it."

For the curculio, see *Plum*.

PEACH BORER. See *Borers*..

PEACOCK. *Pavo cristatus*. The

young birds are good eating, but the full-grown cocks are extremely troublesome in the poultry-yard, from their voracity and tyrannical habits towards chickens.

PEAR. *Pyrus communis.* The varieties are very numerous: they may be classified into summer, autumn, winter, and perry kinds.

The following is from several lists:

SUMMER KINDS.

"Ah! Mon Dieu.—Size medium; form handsome; colour rich yellow, with bright red cheek; flesh juicy; flavour sweet and perfumed. Tree vigorous and productive, the fruit growing in clusters of four or five together.

"Beurré d'Amanlis.—A fine early pear. Size large; form obovate; colour green, changing to yellow, with a fine blush when fully ripe, and russet spots; flesh melting, sweet, and excellent: ripe in August and September. Tree vigorous and productive.

"Dearborn's Seedling.—The tree is of vigorous growth; fruit of medium size, rounded at the crown, and regularly diminishes to the stalk; the skin is smooth, thin, green, with russet spots; at maturity it turns to a delicate yellow; flesh very melting, and of the finest flavour: ripe in August.

"Honey Pear, *American Honey.*—This pear in size and shape resembles the Seckle; the skin is yellow, with a large portion of dull red; the flesh sweet, juicy, and good.

"Jargonelle, *Epargne, Beau Present, Saint Samson, Grosse Cuisse Madame, Saint Lambert, Poire des Tables des Princes.*—Fruit rather large, oblong, of a pale green colour, a little marked with red; flesh melting, juicy, with a slightly acid, rich, and agreeable flavour. It ripens early in August, is one of the most productive of all pears, and the very best in its season.

"Madeleine, *Magdalene, Citron des Carmes, Early Chaumontelle.*—This pear is of medium size, pale yellow, with an occasional blush next the sun; flesh white, melting, perfumed.

"Rousselet de Rheims, *Musk or Spice Pear.*—Fruit small, pyramidal, greenish yellow at maturity, but brown red next the sun, with russety spots; flesh half beurré, juicy, very perfumed.

"Stevens's Genesee Pear.—A beautiful pear, of medium size, and of rather an oblong form; its colour is mellow green, with russet blotches; its flesh is represented as white, juicy, and melting; flavour sprightly, rich, and very delicious: ripens towards the end of August.

"Summer Francreal, *Francreal d'Eté, Fondante, France Cannel, Gros Micet d'Eté, Milan Blanc, Prebles Beurré.*—Fruit above medium size; shape oblong; thickest about one third from the eye; skin yellowish green; flesh melting, rich, and excellent: ripe early in September.

"Summer Melting, *Summer Beurré, Fondant d'Eté.*—An excellent summer pear, of pyriform shape; colour yellow, tinged with brownish red; flesh soft, melting, and sweet. The tree bears young, and ripens its fruit in August.

"Williams's Bonchrétien, *Bartlet, William's Early, Autumn Superb of Prince.*—The fruit is large, oblong; the stalk thick and fleshy, an inch long; the colour at maturity yellow, tinged with red; flesh whitish, very melting, and delicate; juice perfumed, sweet, and abundant. Tree very productive, and fruit ripe early in September.

AUTUMN KINDS.

"Belle et Bonne, *Belle de Flanders, Gracieuse.*—Fruit very large, globular, depressed; the stalk long; skin greenish yellow, but next the sun yellow, with spots of russet; flesh white, sweet, exceeding rich, and agreeably perfumed. The tree is very productive, and the fruit ripens in September.

"Belle Lucrative.—A beautiful Flemish pear; middle sized, roundish, tapering at the stalk; skin yellow, slightly russeted, and tinged with pale red; flesh melting, sweet, and juicy, with a slight musky perfume: ripe early in October.

"Beurré Bosc.—Fruit large and very long; terminated with a crown near three inches in diameter; somewhat calabash-formed; skin gray fawn colour, but russety yellow at maturity; flesh white, melting, highly flavoured, and delicious: it ripens in October.

"Bleeker's Meadow.—A native fruit of medium size, roundish form, and of a yellow colour, tinged with dull red; the flesh melting, juicy, sweet, musky, and of delicious flavour: ripe in October. A prolific bearer.

"Capiamont, *Beurré de Capiaumont.*—Fruit of medium size; skin yellow, tinged with fine red or cinnamon; flesh yellowish, melting, very rich, and high flavoured: ripe in September and October.

"Cushing.—Medium size and oblong shape; skin, when ripe, smooth, of a light yellow, mottled with dull red on one side; flesh white, melting, sprightly, and good. Mr. Manning says it comes early into bearing, and produces plenty of fruit in September and October.

"Delices d'Ardenpont, *Delices d'Hardenpont.*—Fruit above medium size; oblong, pyramidal; skin yellow at maturity, and partially covered with a thin cinnamon-coloured russet; flesh yellowish white, nearly melting; juice pleasant, sweet, and abundant: ripe in October and November. The tree is a good bearer.

"Dix.—A native variety; originated in the garden of Mr. Dix, in Boston; fruit large, oblong; skin, when ripe, yellow, with a blush of red; flesh melting, juicy, and rich: ripe in October and November.

"Duchess of Angouleme, *Duchesse d'Angoulême.*—A pear of first-rate excellence. Form roundish, oblong, tapering towards the stalk; skin dull yellow, with broad russet patches; flesh white, rich, melting, very juicy, and high flavoured, with a most agreeable perfume. Specimens of this fruit have been shown weighing twenty-two ounces: at perfection in October and November.

"Flemish Beauty, *La Belle de Flanders.*—A fine Flemish pear in great repute. It is of large size, obovate, obtuse at the stalk; greenish yellow russet, tinged with crimson; flesh rather firm, yellowish white, sweet, rich, and excellent: it ripens in October.

"Frederic of Wurtemberg, *Roi de Wurtemberg, Capiaumont of some collections.*—A large and splendid pear, of pyramidal form and fine yellow colour, covered with beautiful crimson on one side; flesh melting, and of delicious flavour. The tree bears while young, and very abundantly.

"Fulton.—A fine pear of medium size; shape roundish, turbinate; skin dark yellow, russeted; flesh melting, juicy, and of delicious flavour: ripe in September, and lasts a month. The tree is a great and constant bearer, and highly deserving of cultivation.

"Gansel's Bergamot, *Broca's Bergamot, Ives's Bergamot, Bonne Rouge.*—Fruit varying from middle size to large; ovate, flattened; colour dull green, slightly red next the sun; flesh white, melting, sweet, rich, and high-flavoured. A delicious pear: ripe in October, and good till Christmas.

"Golden Beurré of Bilboa.—Fruit of medium size, oblong; colour a bright golden yellow, with patches of russet; perfectly melting, and of fine flavour. A beautiful pear-tree, a great bearer, and worthy of cultivation: ripe in October.

"Hacon's Incomparable, *Norfolk Seedling.*—Fruit middle sized, of pale yellow colour, mixed with green, partially covered with orange russet; flesh yellowish white, slightly gritty, but very tender, juicy, sweet, and rich, and possessing a high musky and perfumed flavour. The tree is a great bearer, and the fruit excellent: ripe in November and December.

"Henry the Fourth, *Henri Quatre.*—Fruit of medium size, oblong; skin a dull yellow, mixed with brown and green; flesh yellow, rather gritty, juicy, and melting, with a peculiar rich flavour: ripe in September and October. Mr. Manning says the tree bears while young, and abundantly.

"Marie Louise, *Marie Chrétienne.*—Fruit oblong, tapering towards both ends; size varying from medium to large; skin nearly smooth, yellowish green, and cinnamon-coloured russet; flesh white, melting, juicy, and rich. It ripens in October and November, and is an excellent fruit in its season.

"Napoleon, *Roi de Rome.*—Fruit large, form of the Colmar; skin smooth; colour bright green, but at maturity pale green; flesh very melting, with an unusual abundance of rich, agreeable juice: in perfection in October and November.

"Seckle, *New-York Red Cheek, Red Cheek Seckle, Syele.*—An excellent native fruit, in size rather small; colour varying from yellowish to brownish russet, but bright red next the sun; flesh melting, spicy, and of a most extraordinary rich flavour. This fruit grows in clusters in great abundance, and is in perfection in September and October.

"Swan's Egg.—Fruit small, of an oval figure; colour yellowish green, and dull, russety brown; flesh tender and melting, with a rich, saccharine, musky flavour. An excellent fruit: ripe in October. The tree is large, vigorous, and productive.

"Urbaniste, *Beurré du Roy.*—The fruit is of medium size, pyramidally ovate; skin pale green, inclining to yellow, with green streaks; flesh white, but reddish-yellow next the core; it is quite melting, juicy, and very sweet, with a little perfume: it ripens from the middle of September to November.

"White Doyenne, *Doyenne Blanc, Saint Michael.*—Fruit pretty large, roundish, oblong; skin pale citron yellow, with cinnamon russet, speckled; flesh white, juicy, very buttery, and delicious: ripe in September and October. An old and once-celebrated variety, still admired by many, although excluded from some nurseries, or cultivated under new names.

"Wilkinson.—A native pear from Cumberland, Rhode Island. The tree bears young, and is very fruitful; size above medium; form oblong; skin yellow, with a brownish blush near the sun; flesh white, juicy, and melting: in perfection in October and November.

WINTER KINDS.

"Beurré d'Aremberg.—The tree is a great bearer, comes early into cultivation, and the fruit will keep till March. Fruit large, skin of a delicate pale green, dotted with russet, which becomes of a deeper yellow at maturity; flesh whitish, fine, very juicy, perfectly melting, and very extraordinarily rich, sweet, high flavoured, and excellent.

"Beurré Diel, *Beurré Incomparable of some.*—This ranks among the best of pears. The tree is of vigorous growth; fruit, when in perfection, four inches long, and three inches broad; the skin at maturity is bright orange, with reddish russet; flesh clear, white, melting, juicy, and of a delicious aromatic flavour: from November to January.

"Beurré Rance, *Beurré Epine. Hardenpont de Printemps.*—This is a first-rate pear. The tree is vigorous, and a good bearer; fruit middle sized, oblong; skin deep green, with russety specks; flesh green, melting, having a rich, delicious flavour, with very little acid. It shrivels in ripening, but will keep till April.

"Catillac.—Fruit very large, rather turbinate; pale yellow, stained with red; flesh firm and breaking; its flavour astringent; an excellent baking pear: from November to April. Specimens of this variety have been known to weigh upward of two pounds.

"Colmar, *Colmar Souverain, Poire Manne, Bergamotte Tardive, Incomparable.*—This fruit is rather large; skin smooth, of a green colour, changing to a yellow at maturity; form pyramidal; flesh melting, juicy, saccharine, and of excellent flavour. The fruit is in perfection from November to February.

"Columbia, *Columbian Virgalieu.*—A large native pear of oblong or pyramidal form, and fine yellow colour, tinged with red; flesh rich, firm, juicy, and excellent: from November to January. Tree productive and of very handsome form.

"EASTER BEURRÉ, *Beurré d'Hiver, Doyenné d'Hiver.*—Of all the late-keeping pears, this is considered the best. Fruit large, roundish, oblong; colour green, but yellow at maturity, with specks of russet brown; flesh yellowish white, perfectly buttery and melting, also extremely high flavoured. It is eatable in November, and will keep till May: it is a most profuse bearer on a quince stock.

"GLOUT MORCEAU, *Beurré d'Aremberg.*—A very large Belgic variety, of great excellence; fruit of ovalish form, pale green colour, inclining to yellow, with russety specks and blotches; flesh whitish, firm, very juicy, and excellent: in perfection from November to March.

"LEWIS.—The size medium; form somewhat globular; skin, when ripe, a greenish yellow; the flesh is white, very melting, juicy, and excellent: from November to March. The tree grows quick, and bears abundance of fruit.

"LOUISE BONNE DE JERSEY, *Louise Bonne d'Avranches.*—A large pear; oblong; a good substitute for the old *St. Germain;* skin yellowish green, sometimes tinged with red; flesh extremely tender, and full of an excellent saccharine, well-flavoured juice. A first-rate fruit: from October till after Christmas.

"PASSE COLMAR.—A most valuable pear, of medium size, conical, flattened next the eye; skin at maturity yellowish, sprinkled with russet; a tinge of red next the sun; flesh yellowish, melting, rich, and excellent. The tree is a good bearer, and the fruit is in perfection from November to February.

"POUND PEAR.—Fruit very large, of a roundish, turbinate figure; skin rough, covered with dull russet; flesh hard and coarse, but excellent when baked or stewed in winter. Grafted on a pear stock, the tree bears so abundantly as to bend like a weeping-willow. A specimen of this variety weighed thirty-three ounces.

"PRINCE'S ST. GERMAIN.—Fruit about medium size; form obovate; skin russety yellow, with dull red cheek; flesh melting and good. Mr. Manning says that its abundant bearing, and its ripening gradually in the house during winter, renders it a very valuable market fruit: good till after Christmas.

"SURPASSE MARIE LOUISE, *Pitt's Prolific Marie, Pitt's Marie Louise.*—A large pear; oblong or calabash formed; green, covered with brown yellow russet; flesh melting and rich-flavoured: ripe in October and November. It is a very prolific bearer.

"SURPASSE VERGOULEUSE.—Fruit large, oblong, some specimens nearly round; the skin smooth, its colour yellow, with a light-red cheek; flesh rich, juicy, and delicious eating: in October and November. The tree bears young, yields large crops, and is worthy of extensive cultivation.

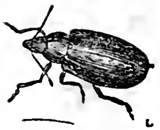
"WINTER NELIS, *Nelis d'Hiver.*—All accounts agree that this is a most excellent winter pear. Its size is above medium, somewhat oval; its skin green and russety, full of gray dots; flesh yellowish white, melting, high-flavoured, with a musky perfume: in perfection in December and January."

They prefer a deep, well-drained, and tolerably rich soil; are planted for standards at twenty feet, but if grafted on quince stocks for dwarfs, may be set at six to ten feet, and trained *en quenouille*, or distaff fashion; they also make good espaliers. Worked on pear stocks, they grow to a great size, and last for centuries; but the quince stock, unless reduced down to the roots, is liable to attacks from worms. It requires usually more than seven years to obtain fruit from a pear standard, but by grafting or budding on the quince, and training distaff fashion, fruit may be obtained in four years.

Diseases of the Pear-tree.—The most formidable is the *blight*, which sometimes occurs in summer, the leaves of the upper branches withering and turning brown in a few hours. It is the effect of insects, according to Peck, of the *Scolytus pyri*, and the only and best remedy is to saw off the blighted limbs at once and burn them.

Harris also mentions the existence of a borer of the same genus as that of the peach (*Ægeria pyri*); it is, however, scarcely known.

The buds are subject to a curculio (*C. pyri*, *Fig.*), of the size of the line, which deposites her egg in the young flower-bud, and retires to the earth in the fall; it is, however, so seldom multiplied to a great extent, that its effects are more beneficial than otherwise, by hindering too much fruit from being formed, and thus improving what remains.



Natural size.

Drying Pears.—The following excellent method is from Kenrick, and is applicable to apples also: "When dried in ovens the fruit will keep for years. This mode of preserving is common in France. Bosc has described two modes of drying pears, and adds, that, in some of the cantons of that country, the cultivators annually preserve, by these means, supplies of subsistence extremely agreeable and wholesome during winter and spring. He invites cultivators not to neglect this resource. In this mode of drying, those varieties of middle size, melting and sweet, are preferred. After the bread is drawn from the oven, they are placed on the swept hearth, or on hurdles or boards. This operation is repeated a second, a third, and even a fourth time, according to their size and the degree of heat. The heat must not be so great as to scorch, and the fruit must not be dried to hardness. Lastly, they are placed in bags, and preserved in a dry place. The second mode of preserving is practised chiefly on the Rousselets and finest flavoured varieties. Bosc states that he has tried them after three years' preservation, and found them still good; but they are better during the first year. They are gathered a little before their maturity, and after being half boiled in a small quantity of water, they are peeled and drained. They are next carried on hurdles to the oven, after the bread is drawn, or the oven is heated to a suitable degree; here they remain twelve hours, after which they are steeped in the sirup, to which have been added sugar, cinnamon, cloves, and brandy. They are again returned to the oven, which is now heated to a less degree than at first. This operation is thrice repeated, until they are sufficiently dried, or of a clear brown colour, and firm, transparent flesh; and, finally, they are packed in boxes lined with paper."

PEARL ASHES. See *Potashes*.

PEAT. "This is a substance of vegetable origin, found wherever the soil has been long soaked with water which has no outlet, and does not completely evaporate by the heat of the sun.

"When dried peat is examined, it is found to consist of roots and fibres in every stage of decomposition, from the natural wood to the completely black vegetable mould. Large branches and trunks of trees are found imbedded in peat, which have no mark of decomposition, except what may have taken place before the wood was completely immersed in the peat. Peat contains the elements of manure, and may by an easy process be converted into humus: for this purpose, the agency of alkalies is the most effectual. When peat is newly dug up, if caustic lime be added to it before it is dry, the moisture of the peat slacks the lime, which acts on the peat and neutralizes it. If this mixture be then excited to fermentation by the addition of animal matter, such as urine or dung, oxygen is absorbed and carbonic acid evolved, and the residue is converted into an excellent manure, containing much humus. The same may be effected more slowly by mixing peat with clay or marl, and allowing the mixture to remain exposed to the atmosphere for a considerable time, frequently turning it; but nothing accelerates this process like the addition of putrescent animal matter, which acts as a ferment and greatly hastens the decomposition.

"The soils for which peat forms the best manure are the chalky and clayey. Sand has too little tenacity; it lets the gases produced by the decomposition escape, instead of attracting them, as clay does, and preventing their escape.

"The burning of peat destroys the vegetable matter, and leaves the earths and salts behind. They are accordingly very strong stimulants to vegetation, especially that of clovers and herbaceous plants, of which the leaves and stems are the most valuable parts. If the soil is well furnished with vegetable matter, and capable of bringing an abundance of seed to perfection, it may be very useful to apply peat ashes to increase the verdure; but on poor soils destitute of humus, the increase of the stems and leaves does not ensure a like increase of seed. Hence it is often remarked that soot, potash, saltpetre, and similar substances produce a deceitful growth, giving a rank green leaf, which is not succeeded by a heavy ear; but, on the contrary, the produce in seed is rather diminished than increased by the use of the manure. Whenever a stimulating manure is used, the soil should be naturally rich, or enriching manure should be applied at the same time.

"The following particulars of the conversion of peat into a rich compost were given by Lord Meadowbank about forty years ago, and show that the principles which we have here laid down were known to him.

"He recommends taking the peat out of the moss some time before it is used, that it may lose a portion of its moisture, and be lighter to carry. It is then to be carted to a dry spot, where the compost heap is to be formed. A bottom of peat is to be laid six inches deep and fifteen feet wide; on this are to be put ten inches of good yard dung, then six inches more peat, and over this four inches of dung, and so alternately to the height of four or five feet. The whole should then be enclosed all round with a wall of peat, and covered with the same material. The proportion of fresh dung is about seven cart-loads to twenty-one of peat, if the weather is mild; but more dung is required if the weather is cold: over this heap ashes or lime may now be spread, in the proportion of a cart-load to twenty-eight of the compost. The dung should not have fermented much before it is used, and if it is watered with urine or the drainings of a dunghill, the effect will be more rapid. Animal matter, such as fish, refuse of slaughter-houses, and every substance which will readily undergo the putrefactive fermentation, will accelerate the process, and save dung in the compost. Where pigeons' or fowls' dung can be procured, a much smaller quantity will produce the desired effect. The heap should not be pressed down, but left to settle by its own weight. If the heat produced by the fermentation is very great, the whole heap may be turned over and more peat added to it. This will keep up the heat till the whole is reduced to a uniform mass of black mould. It may then be put on the land in the same quantity that farm-yard dung would have been, and, consequently, by a little labour, four times the quantity of manure is produced by the mixture of the peat with the dung. It is found that lime is not essential to the formation of this compost. The fermentation excited is sufficient to decompose the tannin and convert it into a soluble extract. The fibres, partially decomposed, are reduced into vegetable mould, and the whole assumes a uniform and rich appearance. A complete chemical change has taken place, and the peat, from being very inflammable, is now scarcely capable of combustion, and that only in a very great heat. There is no better or more economical mode of converting peat into a rich manure. In summer the whole process may be completed in eight or ten weeks; in winter it takes a longer time; and it may be useful to give the heap an occasional lining of fresh dung, as is done with hot-beds in gardens, to renew the heat." The peat is carted out during winter, while the ponds are frozen; it becomes much broken during the season, and may be prepared as recommended, or composted with lime or ashes only, one bushel to the single load of peat.

"Where a great extent of peat land renders the improvement of it desirable, there are various ways in which it may be reclaimed. In some places the peat has been removed, and the loam which lay below it was found of a very fertile nature. This could only be done on the banks of rivers, into which the peat was floated by means of small canals dug through it, and communicating with the river. In all other cases the mode adopted has been that of draining and consolidating. In draining a peat moss the water must not be let off too rapidly, for in that case the surface may become so loose and dry that no vegetation can take place in it. If the water is drained off so as to leave two feet of peat dry above its level, this is all that is required for a beginning. The best improvement, and the most rapid, is produced by bringing sand or gravel in sufficient quantity to cover the surface with two or three inches of it. This will make a beginning of a soil, in which potatoes may be planted. At first the surface will not bear the wheels of a cart nor the tread of a horse; but in a short time a solid crust will be formed, which will increase in strength and thickness as cultivation advances. There are many fine pastures in Scotland which once were brown peat mosses, on which it would have been dangerous for a man to walk, but which now bear heavy oxen, and seem as solid as any pasture on a clay subsoil. Manuring and liming are the most effective operations in bringing about this great improvement. Potatoes and oats are usually the first crops on reclaimed peat mosses. It is long before they become capable of bearing wheat; nor is this crop to be recommended at any time unless there be a good depth of soil formed over the peat. Laying down to grass as soon as a certain degree of improvement has been made, and depasturing with sheep at first and cattle afterward, tend more than any other means to consolidate the surface and deepen the mould, which gradually increases by the decomposition of the tannin in the peat

"A patent has been lately obtained by Mr. Williams, managing director of the Dublin Steam Navigation Company, for compressing peat into a dense mass, so as to resemble coal. It is said to be superior to coal in its properties of producing heat by combustion, forming an excellent charcoal, or coke. It is asserted that this charcoal is much more combustible than that of wood, and very useful in the manufacture of fireworks. Mr. Williams has found that with 10 cwts. of pit coal and 2½ cwts. of this factitious coal, the same quantity of steam can be generated as with 17½ cwts. of pit coal alone.

"The process is as follows: Immediately after being dug it is triturated under revolving edge-wheels faced with iron plates perforated all over the surface, and is forced by the pressure through these apertures, till it becomes a species of pap, which is freed from the greater part of its moisture by a hydraulic press. It is then dried, and converted into coke in the same manner as is done with pit coal. The factitious coal of Mr. Williams is made by incorporating pitch or rosin melted in a caldron with as much of the peat charcoal ground to powder as will form a tough doughy mass, which is then moulded into bricks."—(*W. L. Rham.*)

The ashes of peat are often termed Dutch ashes: they vary much in composition, as they are taken from a calcareous or clayey soil, but are usually deficient in potash and soda, except in salt marshes.

PECK. A dry measure of two gallons; a quarter of a bushel.

PECORA. The *Ruminantia.*

PECTIN. The jelly of fruits, roots,

and plants: it is soluble, transparent, insipid, and much like gum; formula, $C_{12} H_{17} O_{11} + H O$. *Pectic* acid is very similar, isomeric, and bibasic; the salts are called pectates.

PECTINATE. Divided so as to resemble the teeth of a comb.

PECTORAL (from *pectus, the chest*). Relating to the chest.

PEDATE. Resembling the foot of a bird.

PEDICEL. The foot stalk of the flower, and not of the bunch of flowers, which is the peduncle.

PEDIMENT. The triangular ornament over a building, door, window, &c.; it is often sculptured, and seldom exceeds in height two ninths of its width.

PEDIPALPS. Spiders and other arachnidans, with the feelers in the shape of claws.

PEE-TSEE. The water chestnut.

PEDUNCLE. The main flower stem.

PELLICLE. A delicate covering, film, or membrane.

PELLITORY OF SPAIN. *Anthemis pyrethrum.* A perennial herbaceous composite, the root of which is very pungent, and is chewed for toothache. It is very similar to chamomile.

PELTA. A shield; the seed shield of some lichens. A *peltate* leaf is shield-shaped.

PELT ROT. *Hunger rot.*

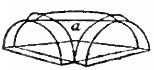
PELTRY, PELTS. The dry, unprepared skins of animals.

PELVIS. The bony cavity situated at the lower part of the belly, formed by the sacrum and innominata bones.

PENCIL OF LIGHT. A divergent beam of small size.

PENDANT. "In Gothic architecture, an ornamented polygonal piece of stone or timber hanging down from the vault or roof of a building. In ancient writers the springers of arches, which rest on shafts or corbels, are called *pendants*."

PENDENTIVE. "In architecture, the portion of a vault between the arches under a dome, called by the French



fourche, or *panache*, lettered *a* in the diagram, by which it will be seen that it falls at its superior part into a circle inscribed in the square formed on the plan of the four arches. Hence it is obvious that a dome may be formed by means of pendentives over any regular polygon."—(*Brande.*)

PENDULOUS. Hanging, branching over.

PENDULUM. Any weight suspended by an inflexible rod, and moving freely about a point. Its oscillations, whether wide or limited, are always performed in the same period of time; but the period is directly as the square root of the length of the rod. The seconds pendulum in New-York is 39·1012 inches from the point of suspension to the weight, or bob.

PENNICILLATE. Furnished with small bunches of hairs.

PENNYROYAL. *Mentha pulegium.* A kind of mint cultivated for its essential oil: used in medicine. See *Mint.* The American plant is *Hedeoma pulegioides;* its odour is similar to that of the European plant; many insects, especially ticks, are remarkably annoyed by its presence.

PENNYWEIGHT. Twenty-four grains, or $\frac{1}{20}$ of an ounce troy.

PENTAMERANS. Coleopterous insects, with five joints on the tarsus of each leg.

PENTANDRIA, PENTAGYNIA. See *Botany.*

PENUMBRA. The partially dark outer shadow.

PEPO. The form of fruit similar to the melon and other cucurbitaceæ.

PEPPER BRAND. See *Burned Ear.*

PEPPER GRASS, PEPPERWORT. Garden cress (*Lepidium sativum*), cultivated for small salad: it grows with great rapidity. See *Cress.*

PEPPERIDGE. The barberry: sometimes the black gum.

PEPPERMINT. *Mentha piperita.* See *Mint.* It is of great use as an adjunct with cathartics, to hinder griping.

PEPPERS. This term is usually applied, in agriculture, to the species of *Capsicum.* The most common is the *C. baccatum.* The following varieties are cultivated: Bell, long red, cherry, tomato-shaped, and sweet Spanish. The latter is used as a salad, and the bell is perennial. Sow early in May in a warm bed and fine soil; transplant when two inches high, and set at two feet apart. The soil should be dry and light, but rich, and the plants hoed and weeded. For pickles, they should be collected before ripening: for curing meat, when beginning to dry; hang them in the air until quite dry. The powder rubbed upon hams and salt meats preserves them, in some measure, from insects; and the smoke, which is peculiarly pungent, is very distressing to them. Cayenne pepper is the powder of the *C. baccatum.*

PEPPERS, INDIAN. *Piper nigrum* (*Fig. a*). An endogenous climbing shrub of Sumatra, the fruit of which appears on spikes at three years, and forms the black pepper of

commerce. The same, hulled by rubbing, constitutes white pepper. The celebrated betel, or intoxicating pepper, chewed by the natives of India with lime (*chunam*), is the fruit of the *Piper betle* (*Fig. b*).

PEPSIN. Albuminous matter of the stomach and gastric juice in a state of change. It forms the active agent of rennet, and, with a little muriatic acid, has been made to produce artificial digestion.

PER. A chemical prefix to those compounds which contain the highest proportion of the element against which it is placed; as peroxide, perchloride, &c.

PERCH. The $\frac{1}{40}$th of a rood, 30¼ square yards; in long measure, 5½ yards.

PERCHERS. The *Incessores,* birds which perch on trees, including the *Scansores* and *Passeres.*

PERCHLORIC ACID. An acid consisting of 1 eq. chlorine with 7 oxygen, which forms a sparingly soluble compound with potash, the *perchlorate,* and has hence been used as a test for that alkali.

PERCOLATION. The slow oozing of water through rocks, earths, or other slightly porous structures.

PERENNIALS. Plants whose roots live several years, but the tops die annually.

PERFOLIATE. Leaves through which the stem pass.

PERGAMENOUS. Parchment-like.

PERI. A common affix of descriptive terms, meaning about, or around.

PERIANTH, PERIANTHUM. A flower which has no distinct calyx.

PERICARDIUM. The membrane surrounding the heart: its inflammation is called *pericarditis.*

PERICARP. The outer portion of the fruit surrounding the carpels.

PERICRANIUM. The membrane which is attached to the bones of the skull.

PERIGYNIUM. The case formed in *Carices* by the union of two bracts. The disk.

PERIGYNOUS. Stamens which are attached to the sides of the calyx.

PERIOSTEUM (from *περι, about,* and *οστεον, a bone*). The fibrous membrane attached to the surface of all the bones.

PERIPHERY. The circumference.

PERIPNEUMONY. Pneumonia.

PERISPERM. The testa or covering of a seed.

PERISTALTIC. A worm-like motion of the intestines, produced by a contraction and dilatation of their circular fibres, whereby their contents are pushed forward into the colon and rectum.

PERISTOMIUM. The fringed membrane surrounding the capsule of mosses.

PERITONEUM (from περιτεινω, *I extend around*). The membrane which envelops the organs of the abdomen; it is serous: its inflammation is called *peritonitis*.

PERMEABLE. Permitting the passage of fluids or gases.

PERRY. The cider of pears. See *Pear*, for the best fruit, and *Cider*, for the method of making it.

PERSIAN BERRIES. French berries.

PERSIMMON. *Plaqueminier. Diospyros Virginiana.* A small tree growing in open places in the Middle and Southern sections. The fruit, when frosted, is sweet, and is often mashed and fermented into a beer. The tree is diœcious, and of the same genus as the ebony: the wood is very hard. The green fruit is extremely astringent, and used in medicine.

PERSONATE FLOWERS. Irregular, monopetalous flowers like the snapdragon (*Antirrhinum*), with an upper and lower lobe, but with the faux or throat closed: in this respect it differs from the labiate corolla.

PERSPIRATION. The function of the skin whereby a saline fluid with a little gaseous matter is thrown out of the body. It is increased by taking much fluid in summer; and the state of this excretion is closely connected with health.

PERUVIAN BARK. The bark of several varieties of *Cinchona* trees of Central and South America: they furnish the invaluable alkaloid *quinine.*

PETALS. The divisions of the flower: the leaves of the flower, usually of bright colours. *Petaloid* is a derivative.

PETIOLE. The leaf stalk.

PETROLEUM. *Barbadoes tar.* Natural bitumen.

PETROSILEX. Hornstone, sometimes compact feldspar.

PETUNTZE. Porcelain clay, decayed feldspar.

PHAGEDENIC. Corroding ulcers.

PHALANGES. The small, long bones of the fingers and toes.

PHANEROGAMIA, PHANEROGAMOUS. Plants bearing flowers.

PHARMACOPÆIA. An account of the preparation of medicines.

The following formulæ for veterinary practice have been compiled by Loudon from the works of the most eminent veterinary writers of the present day; and he confidently recommends the selection to the notice of agriculturists, and the owners of horses in general. It would be prudent for such as have many horses, and particularly for such as live at a distance from the assistance of an able veterinarian, to keep the more necessary articles by them in case of emergency: some venders of horse drugs keep veterinary medicine chests; and where the compositions can be depended on, and the uncompounded drugs are genuine and good, one of these is a most convenient appendage to every stable.

"The veterinary pharmacopæia for oxen, calves, and sheep has been included in the arrangement. When any speciality occurs, or where distinct recipes are requisite, they have been carefully noticed; it will, therefore, only be necessary to be kept in mind, that with the exception of acrid substances, as mineral acids, &c., which no cattle bear with equal impunity with the horse, the remedies prescribed require about the following proportions: A large ox will bear the proportions of a moderate-sized horse; a moderate-sized cow something less; a calf about a third of the quantity; and a sheep about a quarter, or, at most, a third of the proportions directed for the cow. It is also to be remarked, that the degrees in strength in the different recipes are usually regulated by their numbers, the mildest standing first.

Alteratives.

1.

Levigated antimony, 2 drachms.
Cream of tartar,
Flower of sulphur, each half an ounce.

2.

Cream of tartar,
Nitre, of each half an ounce.

3.

Æthiops mineral,
Levigated antimony,
Powdered resin, each 3 drachms.

"Give in a mash, or in corn and bran a little wetted, every night, or make into a ball with honey.

Tonic Alteratives.

1.

Gentian,
Aloes,
Ginger,
Blue vitriol, in powder, of each 1 drachm.
Oak bark, in powder, 6 drachms.

2.

Winter's bark, in powder, 3 drachms.
Green vitriol, do., one and a half drachms.
Gentian, do., 3 drachms.

"Make either of these into a ball with honey, and give every morning.

3.

White vitriol, 1 drachm
Ginger or pimento, ground, 2 drachms.
Powdered quassia, half an ounce.
Ale, 8 ounces.—Mix, and give as a drink.

Astringent Mixtures for Diarrhœa, Lax, or Scouring.

1.

Powdered opium, 20 grains.
Prepared chalk, 2 ounces.
Boiled starch, 1 pint.

2.

Suet, 4 ounces; boiled in
Milk, 8 ounces.
Boiled starch, 6 ounces.
Powdered alum, 1 drachm.

3.

"The following has been very strongly recommended, in some cases, for the lax of horses and cattle, when it arises from taking food that disagrees:

Glauber's salts, 2 ounces.
Epsom do., 1 ounce.
Green vitriol, 4 grains.
Gruel, half a pint.

4.

"When the lax or scouring at all approaches to dysentery or molten grease, the following drink should be first given:

Castor oil, 4 ounces.
Glauber's salts (dissolved), 2 ounces.
Powdered rhubarb, half a drachm.
Powdered opium, 4 grains.
Gruel, 1 pint.

Astringent Balls for Diabetes, or Pissing Evil.

Catechu (Japan earth), half an ounce.
Alum, powdered, half a drachm.
Sugar of lead, 10 grains.
Conserve of roses to make a ball.

Astringent Paste for Thrush, Foot-rot, Foul in the Foot, &c.

Prepared calamine,
Verdigris, of each half an ounce.
White vitriol,
Alum, of each half a drachm.
Tar, 3 ounces: mix.

Astringent Washes for Cracks in the Heels, Wounds, Sprains, &c.

1.

Sugar of lead, 2 drachms.
White vitriol, 1 drachm.
Strong infusion of oak or elm bark, 1 pint: mix:

2.

Green vitriol, 1 drachm.
Infusion of galls, half a pint.

"Mix, and wash the parts three times a day.

Powder for Cracks, &c.

3.

Prepared calamine, 1 ounce.
Fuller's earth, powdered,
Pipe clay, do., of each 2 ounces.

"Mix, and put within gauze, and dab the moist surfaces of the sores frequently.

Astringent Paste for Grease.

1.

Prepared calamine,
Charcoal, powdered, of each 2 ounces.
Yeast enough to make a paste.

2.

"To the above, if more strength be required, add of alum and verdigris each a drachm.

Astringent Wash for Grease.

3.

Corrosive sublimate, 2 drachms.
Spirit of wine or brandy, 1 ounce.
Soft water, 10 ounces.

"Rub the sublimate in a mortar with the spirit till dissolved, then add the water. This is a strong preparation, and has often proved successful in very bad cases of grease, which have resisted all the usual remedies.

Blisters.

1. A general one.

Cantharides, powdered, 2 ounces.
Venice turpentine, do.
Resin, do.
Palm oil or lard, 2 lbs.

"Melt the three latter articles together, and when not too hot stir in the Spanish flies.

2.

A strong, cheap Blister, but not proper to be used in Fevers or Inflammations, as of the Lungs, Bowels, &c.

Euphorbium, powdered, 1 ounce.
Oil of vitriol, 2 scruples.
Spanish flies, 6 ounces.
Palm oil or lard,
Resin, of each 1 lb.
Oil of turpentine, 3 ounces.

"Melt the resin with the lard or palm oil. Having previously mixed the oil of vitriol with an ounce of water gradually, as gradually add this mixture to the melted mass; which again set on a very slow fire for ten minutes more: afterward remove the whole, and, when beginning to cool, add the powders previously mixed together.

3.

A mercurial Blister for Splints, Spavins and Ringbones.

Of either of the above, 4 ounces.
Corrosive sublimate, finely powdered, half a drachm.

4.

Strong Liquid Blister.

Spanish flies in gross powder, 1 ounce.
Oil of origanum, 2 drachms.

Oil of turpentine, 4 ounces.
Olive oil, 2 ounces.
"Steep the flies in the turpentine three weeks, strain off, and add the oil.

5.
Mild Liquid or Sweating Blister.

Of the above, 1 ounce.
Olive oil or goose grease, one ounce and a half.

Clysters, a Laxative one.
1.

Thin gruel or broth, 5 quarts.
Epsom or common salts, 6 ounces.

Clyster for Gripes.
2.

Mash two moderate-sized onions.
Pour over them oil of turpentine, 2 ounces.
Capsicum, or pepper, half an ounce.
Thin gruel, 4 quarts.

Nutritious Clyster.

3.

Thick gruel, 3 quarts.
Strong sound ale, 1 quart.

Or 4.

Strong broth, 2 quarts.
Thickened milk, 2 quarts.

Astringent Clyster.

5.

Tripe liquor, or suet boiled in milk, 3 pints.
Thick starch, 2 pints.
Laudanum, half an ounce.

Or 6.

Alum whey, 1 quart.
Boiled starch, 2 quarts.

Cordial Balls.

Gentian, powdered, 4 ounces.
Ginger, do., 2 ounces.
Coriander seeds, do., 4 ounces.
Caraway, do., 4 ounces.
Oil of anise seed, a quarter of an ounce.
"Make into a mass with honey, treacle, or lard, and give one ounce and a half for a dose.

Chronic Cough Balls.

1.

Calomel, 1 scruple
Gum ammoniacum,
Horseradish, of each 2 drachms.
Balsam of Tolu,
Squills, each 1 drachm.
"Beat all together, and make into a ball with honey, and give every morning fasting.

Drink for the same.
2.

Tar water,
Limewater, of each half a pint.
Tincture of squills, half an ounce.

Powder for the same.
3.

Tartar emetic, 2 drachms.
Powdered foxglove, half a drachm.
Powdered squill, half a drachm.
Calomel, 1 scruple.
Nitre, 3 drachms.
"Give every night in a malt mash.

Diuretic Balls.

Resin, yellow, 1 lb.
Nitre, half a pound.
Horse turpentine, half a pound.
Yellow soap, quarter of a pound.

"Melt the resin, soap, and turpentine over a slow fire; when cooling, add the nitre. For a strong dose, an ounce and a half; for a mild one, an ounce. It should be kept in mind that mild diuretics are always equal to what is required, and that strong diuretics are always hurtful.

Diuretic Powders.

Yellow resin, powdered, 4 ounces.
Nitre, do., 8 ounces.
Cream of tartar, do., 4 ounces.
"Dose, 6, 8, or 10 drachms nightly, which some horses will readily eat in a mash.

Urine Drink.

Glauber's salts, 2 ounces.
Nitre, 6 drachms.
"Dissolve in a pint of warm water.

Embrocations.—Cooling for Inflammations.

1.

Goulard's extract, half an ounce.
Spirit of wine or brandy, 1 ounce.
Soft water, 1 quart.

2.

Mindererus spirit, 4 ounces.
Water, 12 ounces.

For Strains.

Bay salt, bruised, half a pound.
Crude sal ammoniac, 2 ounces.
Sugar of lead, quarter of an ounce.
Vinegar, one pint and a half.
Water, 1 pint.

For the Eyes.

1.

Sugar of lead, 1 drachm.
White vitriol, 2 scruples.
Water, 1 pint.

2.

Brandy, 1 ounce.
Infusion of green tea, 4 ounces.
Tincture of opium, 2 drachms.
Infusion of red roses, 4 ounces.

3.

Rose water, 6 ounces.
Mindererus spirit, 3 ounces.

4.

Corrosive sublimate, 4 grains.
Alcohol, 1 ounce.
Lime water, 1 pint.

5.

Alum, powdered, 1 drachm.
Calomel, half a drachm.
"Mix, and insert a little at one corner of the eye. The custom of blowing it in alarms the horse.

Fever Powders.

1.

Tartar emetic, 1 drachm.
Nitre, 5 drachms.

2.

Antimonial powder, 1 drachm.
Cream of tartar,
Nitre, of each 4 drachms.

Fever Drink.

3.

Sweet spirit of nitre, 1 ounce.
Mindererus spirit, 6 ounces.
Water, 4 ounces.

Malignant Epidemic Fever.

4.

Simple oxymel,

Mindererus spirit,
Beer yeast, of each 4 ounces.
Sweet spirit of nitre, 1 ounce.

Fumigations for purifying infected Stables, Sheds, &c.

Manganese, 2 ounces.
Common salt, ditto.
Oil of vitriol, 3 ounces.
Water, 1 ounce.
"Put the mixed manganese and salt into a basin; then, having before mixed the vitriol and water very gradually, pour them, by means of tongs, or anything that will enable you to stand at a sufficient distance, on the articles in the basin gradually. As soon as the fumes rise, retire and shut up the door close.

Hoof Liquid.

Oil of turpentine, 4 ounces.
Tar, 4 ounces.
Whale oil, 8 ounces.
"This softens and toughens the hoofs extremely, when brushed over them night and morning.

Purging Medicines.

Balls—very mild.
Aloes, powdered, 6 drachms.
Oil of turpentine, 1 drachm.
Mild.
Aloes, powdered, 8 drachms.
Oil of turpentine, 1 drachm.
Strong.
Aloes, powdered, 10 drachms.
Oil of turpentine, 1 drachm.
"The aloes may be beaten with treacle to a mass, adding, during the beating, the oil of turpentine. All spices, oil of tartar, cream of tartar, jalap, &c., are useless, and often hurtful additions.

Liquid Purge.

Epsom salts, dissolved, 8 ounces.
Castor oil, 4 ounces.
Watery tincture of aloes, 8 ounces.
"Mix.—The watery tincture of aloes is made by beating powdered aloes with the yolk of egg, adding water by degrees; by these means half an ounce of aloes may be suspended in eight ounces of water; and such a purge is useful when a ball cannot be got down, as in partial locked jaw.

Scalding Mixture for Pole Evil.

Corrosive sublimate, finely powdered, one drachm.
Yellow basilicon, 4 ounces.

Foot Stoppings.

Horse and cow dung, each about 2 lbs.
Tar, half a pound.

Wash for coring out, destroying Fungus, or proud Flesh, &c., &c.

Lunar caustic, 1 drachm.
Water, 2 ounces.

Wash for Mange.

Corrosive sublimate, 2 drachms.
Spirit of wine or brandy, 1 ounce.
Decoction of tobacco,
Ditto of white hellebore, of each 1 pint.
"Dissolve the mercury in the spirit, and then add the decoctions.

Ointments for Healing.

1.
White vitriol, powdered, half a drachm.
Lard, 8 ounces.

For Digesting.

1.
White vitriol, 1 drachm.
Yellow basilicon, 7 ounces.

For Mange.

Sulphur vivum, 8 ounces.
Arsenic, in powder, 2 drachms
Mercurial ointment, 2 ounces.
Turpentine, 2 ounces.
Lard, 8 ounces.
"Mix, and dress with every morning.

For Scab or Shab in Sheep, Mallenders and Sellenders in Horses, and foul Blotches and Eruptions in Cattle in general.

Camphor, 1 drachm.
Sugar of lead, half a drachm.
Mercurial ointment, 1 ounce."

PHARYNX (from φερειν, *to convey*, because the food is conveyed by it into the œsophagus and stomach). The back part of the mouth; it is somewhat funnel-shaped, attached to the fauces behind the larynx, and terminating in the gullet.

PHENECIN. The red hydrate of indigo.

PHENOMENON, plural PHENOMENA. A natural occurrence, or object of a recondite nature.

PHLEAM. The knife used in bleeding horses.

PHLEBOTOMY. An old term for bleeding.

PHLORIDZIN. A silky, bitter, and almost insoluble solid, obtained from the root of the apple, pear, cherry, and plum trees. It closely resembles salicin; formula, $C_{42}\ H_{23}\ O_{18} + 6\ H\ O$. *Phlorizein*, produced by the action of ammonia and air on moist phloridzin, is a red colouring matter; a bright blue is also produced by chemical means.

PHLOX. A genus of handsome flowering plants.

PHOSPHATES. Salts of phosphoric acid.

PHOSPHITES. Salts of phosphorous acid.

PHOSPHORESCENCE. The quality of shining at a temperature below a red heat.

PHOSPHORITE. Native bone earth, or phosphate of lime.

PHOSPHORUS (from *φως*, *light*, and *φερω*, *I carry*). "So called from its property of shining in the dark: it is extracted from bone earth. The bones are calcined, so as to destroy the animal matter, and, being powdered, are mixed with water, to which half their weight of sulphuric acid is added. The bone earth, consisting chiefly of phosphate of lime, is thus decomposed, sulphate of lime is formed, and phosphoric acid is evolved; or, rather, superphosphate of lime, which, being much more soluble than the sulphate, remains in the liquid, and may be obtained by its evaporation. It is mixed with about half its weight of charcoal, and put into a well-luted earthen retort, the beak of which dips into water. At a bright red heat the phosphorus distils over into the water. It is purified by carefully melting it under water, and straining it through a piece of chamois leather.

"Pure phosphorus is an element almost colourless and semitransparent; it may be cut with a knife, and its surface has a waxy lustre. It fuses at 108°, boils at 550°, and is converted into vapour, having, according to Dumas, a density $= 4{\cdot}35$. It is sparingly soluble in fixed and volatile oils, and in ether and alcohol; but insoluble in water. It shines in the dark, and emits a luminous vapour, undergoing a slow combustion, and exhaling a peculiar smell like garlic. When rubbed, or heated to a temperature of about 110°, it takes fire and burns with great rapidity, with a white flame, emitting abundance of acid fumes of phosphoric acid.

"The product of the perfect combustion of phosphorus is phosphoric acid, a fusible substance, very soluble in water, and intensely sour. It appears to consist of 1 equivalent of phosphorus $= 31{\cdot}44$, and 5 of oxygen $= 41$, its equivalent being 71 44.

"There are two other acids of phosphorus, namely, the phosphorous acid, consisting of 31·44 phosphorus + 24 oxygen, and the hypophosphorous acid. When phosphorus is boiled in a solution of caustic potash a gas is evolved, which is remarkably distinguished by its spontaneous inflammability, each bubble, as it rises through the water, taking fire upon the surface and producing a beautiful ring of smoke: this gas is commonly called phosphuretted hydrogen. Phosphorus may be made to combine with the greater number of the metals, forming compounds called phosphurets."

Phosphorus is not found in the elementary state in nature, but in the form of phosphoric acid it is combined with lime, magnesia, alumina, and many metals, forming native phosphates. Most of these are insoluble in pure water, but dissolve in acids and in carbonic acid water. In this solution they are carried to plants, which have the property of decomposing them, and assimilating the phosphorus. Fibrin, albumen, some oils, and other products of vegetation, contain phosphorus. It is to all vegetation an essential body, especially for the production of seeds. Bone earth, or phosphate of lime, is the principal source for manure; but urine, and the dung of all animals, contain phosphates.

It is frequent to see a distinction made between phosphoric, metaphosphoric, and pyrophosphoric acids; but these have all the same basis, the phosphoric acid being tribasic, and forming three sets of salts with some bodies which are different in characters.

PHOTOMETER (from *φως*, and *μετρον*, *a measure*). An instrument to measure the intensity of light.

PHRENITIS. Inflammation of the brain.

PHRYGANIDÆ. Tricopterous insects, case-worm flies.

PHYCOMETER. The gelatinous matter in which the sporules of the lowest plants germinate.

PHYLLODIA. Leaves in which the petiole is very much expanded and the lamina absent.

PHYSICS. Mechanical philosophy. The study of the properties of objects and their motions.

PHYSIOLOGY. The investigation of the properties and functions of plants and animals.

PHYTOGRAPHY. Descriptive botany.

PIA MATER. The delicate membrane covering the brain.

PIAZZA. An arcade.

PICAMAR. A bitter substance found in tar.

PICIDÆ, PICE. The family of woodpeckers.

PICK. A pickaxe.

PICKLING. The preservation of vegetables or meats in vinegar or brine.

PICROMEL. Sugar of bile: bilin, changed by the action of acetic acid, &c.

PICROTOXIA. A poisonous alkaloid in *Cocculus Indicus.*

PIE. A mould, or rounded mass of earth, compost, &c.

PIER. In architecture, the solid between the openings of a building, or that from which an arch springs. An abutment pier, in a bridge, is that next the shore.

PIG. See *Hog.*

PIGNUT. See *Hickory.*

PIGEON. Birds of the genus *Columba*; the young are tender, and used as food, to some extent. The dung is a choice manure, and collected with great care and expense in the East for melons: it is the same as poultry dung. The full-grown birds are tough, but may be rendered tender by cooping for 10 days or more, and feeding with Indian meal.

PIGGERY. See *Hog-sty.*

PILASTER. A square pillar situated in a wall, usually projecting not more than one fifth or one sixth of its width. Pilasters are subject to the same rules of proportion as columns.

PILCHARD. A small kind of herring.

PILE. The hair on furs.

PILES. Timbers driven into a marshy soil to afford a better foundation. In surgery, enlargement of the veins of the rectum.

PILEUS. The cap of a mush-room.

PILOSE. Hairy, set with hairs.

PIMENTO. *Myrtus pimenta.* Allspice. The aromatic berries of an evergreen tree of Jamaica and the tropics of America.

PIMPERNEL. *Anagallis arvensis.* A pretty, indigenous annual.

PINDARS. *Arachis hypogæa.* The ground pea. The following, from Mr. M'Caughan, of Mississippi, is worthy of the attention of Southern planters:

"I planted, the 18th of February last, three acres in pindars, in rows five feet apart, the peas about 12 inches apart, in a common small furrow made with a bull-tongue plough, on level ground, having first broken up and harrowed it well. The weather afterward, in March, was very cold, wet, and unfavourable, and killed many of the peas which had sprouted, so that I had a very poor stand; they, however, grew finely, and interlocked across the rows, and covered the ground pretty well. On the 27th of October I began digging (for fear of frost) by loosening the ground a little round the bunch with an iron fork with three prongs, each above 13 inches long, and then pitched the fork under the tap root and pressed it up; a hand follows and lifts up the bunch, most of the pease adhering to it, and shakes the *sand* (dirt we have none) all off, and lays it out straight to cure like hay; when sufficiently cured, tie up in bundles the proper size for a cutting-box, and stow away for winter food for horses, cows, &c., than which there can be nothing better or more nutritious. The pindars that are torn from the vine are partly left on the top of the ground, and can easily be picked up after a rain; I then turn the hogs in, and they gather the balance, and fatten as finely on them as on corn. Our poorest land will yield 50 to 80 bushels of the pease, and over a ton of hay per acre, and altogether I regard it as one of the finest crops the Southern farmer can raise. If we could afford to give an entire crop to the land, I am persuaded it would be quite as good as a crop of your best red clover to fertilize it. There has been a mistaken policy pursued, almost universally, in cultivating the pindar, by covering over the top with earth when they begin to bloom; this is not only unnecessary, but positively injurious; although the top, or vine, grows straight up at first, yet when it is time to seed, the small fibres on the end of which the pea grows arise, the vine inclines to the ground until it finds a proper location, and then extends its branches, two, three, or four feet in length in every direction, touching the earth. The only cultivation requisite is to keep the ground loose and clear of weeds and grass, and as level as possible, so that the fibres on which the pea grows can penetrate the ground easily. I intend, next year, to plant pindars in hills, or, rather, in checks, two feet apart each way, which will cause them to grow in upright bunches, yielding more hay, and will be easier dug, and, I think, will probably yield as many peas."

The pindar is a legumen, like the pea and bean, and it is, when raised for seed, as exhausting. It differs from them in containing a large amount of oil, and is therefore much more fattening, and equally nutritious as respects the strength of animals. Lime and bone earth would be found capital manures. The green stems, ploughed in, are equal to clover as a fertilizer.

PINEAL GLAND. A small gland of the brain.

PINEAPPLE. *Bromelia ananas*. A native of the American tropics, with dry, spiny leaves. The supply of this fruit is so great, and the price so cheap, that no inducement is offered for its cultivation, which is tedious, and requires a full supply of heat. The woody fibres of the leaves are readily separated by dew-rotting, and are said to form a silky flax, which has been made use of to a limited extent in manufactures.

PINE BARREN. The extensive districts of sandy lands in the South on which the pine only grows. It is supposed by naturalists that they would become deserts if the trees were once removed, for they are watered chiefly by the moisture attracted by the trees.

PINE-TREE. The genus *Pinus*, the trees of which afford the well-known timber, as well as tar, turpentine, &c. The pines are distinguished from firs, larches, and spruces by their needle-shaped leaves, grouped in twos, threes, &c., and collected into a sheath at the base. The *P. strobus*, or white pine, also called Weymouth pine, yields nearly all the choice deals of the country: the leaves are in fives. The *P. palustris* yields the tar and resin of North Carolina; it is southern, but the *P. rigida*, which is more extended, and fills the barren, sandy lands of the seaboard, is also rich in tar. The *P. Canadensis*, or hemlock, furnishes timber, and the bark is used in tanning. The old field pine of the South is the *Pinus tæda*; the young shoots, or browse, are very healthy and nutritious for sheep; they answer well to protect autumn and spring garden crops from frost. The pines are readily propagated by seeds, which are found in the cones before they have been exposed too long. They may be budded, or, rather, grafted in the growing, tender shoots, with a little care, but not on the drier wood. Several species of pines produce seeds in their cones, which are sufficiently large to be obtained for food. In Italy, the *P. pinea* yields a large, excellent nut, much esteemed; some of the Mexican pines also produce edible fruit.

PINING. A disease of sheep, languishing. "It is most fatal in a season of drought, and June and September are the most deadly months. If ever a farmer perceives a flock on such a farm having a flushed appearance of more than ordinarily rapid thriving, he is gone. By that day eight days, when he goes out to look at them again, he will find them lying, hanging their ears, running at the eyes, and looking at him like so many condemned criminals. As the disease proceeds the hair on the animal's face becomes dry, the wool assumes a bluish cast, and if the shepherd have not the means of changing the pasture, all those affected will fall in the course of a month."

PINION. A small wheel playing in the teeth of a larger one. It is sometimes only a spindle or arbor.

PINK. The genus *Dianthus;* perennial flowering plants, propagated readily by layering.

PINK ROOT. *Spigelia Marilandica.* Carolina pink, a handsome perennial, growing about the borders of woods in the South; the roots are used in infusion as a powerful vermifuge; the dose for children of three years is 10 grains of the powder: in very large quantities it proves a dangerous narcotic.

PINNACLE. A square or polygonal pillar rising above a building, and terminating in an ornamental pyramid.

PINNATE. Leaves with separate leaflets arranged along the midrib, or petiole: some are doubly pinnate.

PINNATIFID. Imperfectly pinnate. In this case the leaflets are not distinct, but a portion of the lamina runs along the central petiole. Cut-leafed.

PINT. The eighth part of a gallon; half a quart.

PIP. A disease of poultry, attended with the formation of a tough membrane at the tip of the tongue, which hinders feeding; it is cured by pulling off the membrane and washing the part with salt: the cause is said to be bad water and food, which should be changed.

PIPE. A wine measure of rather uncertain capacity—105 imperial, or 126 wine gallons.

PIPE CLAY. White clay, disintegrated feldspar found in primitive regions, with which the white smoking pipe and coarse pottery are made.

PIPERIN. A white, crystalline, inactive alkaloid, obtained from black pepper.

PISE. In building, a wall constructed of stiff earth or clay, carried up in moulds, and rammed down as the work is carried up. The expression, building *en pise*, is common.

PISOLITE. Native limestone, moulded into grains like peas.

PISTACHIO, or PISTACHIA NUTS. *Pistachia vera.* A turpentine-tree, a native of Syria; the nuts are the size of small filberts, of a sweet taste and pleasant flavour resembling almonds.

PISTIL, PISTILLUM. The central organ of flowers; it is divided into an *ovarium*, or lowest part, a *style*, and *stigma*, which last is the uppermost surface, and receives the fertilizing pollen. It is called the female organ, because flowers in which it is absent are barren. Pistils are made of one or more carpels, the styles of which unite. Flowers with pistils only are termed *pistillate.*

PISTON. A short cylinder of wood or metal, which fits exactly the cavity of a pump or barrel, and is worked up and down in it alternately. Two sorts of pistons are used in pumps: one hollow, with a valve, used in the sucking pump; and the other solid, which is employed in the forcing pump.

PITCH. The substance that remains after boiling or distilling tar; it is used as a coarse paint when warmed.

PITCH OF A ROOF. Its inclination to a level plane.

PITHING. The operation of killing animals suddenly and without loss of blood, by driving a knife into the spinal marrow: this is done by directing the knife to the space between the first and second vertebra, or rack bones.

PITTACALL. A blue substance obtained from oil of tar.

PITUITARY GLAND. The pineal gland, situated in the base of the brain.

PITUITARY MEMBRANE, SCHNEIDERIAN MEMBRANE. The mucous membrane of the nostrils.

PITYRIASIS, DANDRUFF. A scurfy disease of the skin.

PIVOT. The extremity of an axle which revolves in a socket or hole.

PLACENTA. The after-birth. A

large spongy organ which receives the blood of the mother, and supplies, by the umbilical artery, the fœtus.

In botany, cellular tissue developed within a carpel, to which the ovules are attached sometimes by an umbilical cord.

PLAITED, PLICATE. In botany, folded like a fan.

PLAGUE. A violent, contagious, and typhoid disease.

PLANARIA. A genus of flat entozoic animals, which do not, however, inhabit the bodies of other animals.

PLANE. A flat surface.

PLANE TABLE. A square board, furnished with a compass, and with lines drawn on its upper side, used in taking angles and in measuring land.

PLANE-TREE. The buttonwood.

PLANER-TREE. *Planera ulmifolia* (*aquatica*). A tree of twenty-three to thrity feet height, growing in swampy places, in the South and Southwest, and resembling the elm. The wood is hard and strong, but there is only a small amount of it.

PLANIPENNATES. Neuropterous insects with flat wings, the lower pair of which equal the upper.

PLANKS. Boards of nine inches or more in width, and one to two inches thick ; they are sold by the square foot.

PLANO-CONCAVE. A thin disk, having one surface flat and the other curved inward (*concave*).

PLANT. A complex organization, produced from seeds or sporules. The most general characters are the presence of cellular tissue, and the power of decomposing carbonic acid in light ; but the latter function does not belong to fungi.

PLANT CASES, WARD'S. Tight glazed boxes, at the bottom of which a layer, six inches deep, of garden mould, in a moist state, is placed ; and in which plants being set, are said to grow without farther trouble if the case be well closed.

PLANTAIN. The genus *Plantago* ; for the most part perennial weeds in meadows ; they are nutritious, but grow too small for hay. The *P. major* is called white man's footsteps ; it is commonly recommended as an application to wounds, being mucilaginous.

PLANTATION, PLANTING. "Planting is the operation of placing in the soil the roots of a plant which has been previously removed ; and the preservation of the roots is the first thing to be attended to. It should be kept in mind that the *spongioles*, or delicate extremities of the fibres, are the parts by which the chief supply of food from the earth is absorbed by the plant. Their tissue being tender and almost naked, they are very susceptible of injuries from mechanical action ; and being adapted for performing their functions in a humid medium, they readily suffer from being kept for any length of time exposed to free air and drought. In taking up the plants, therefore, the roots should be loosened in such a manner as to receive the least possible violence in the operation. Plants in pots can be shifted from one place to another without exhibiting symptoms of deranged functions ; and if it were possible to preserve the spongioles of a large tree as entire as those of a plant in a pot, the same successful result would follow ; but as it is next to impossible to do this, we can only attempt to preserve them as far as circumstances will permit. If the tree be large, a trench should be opened beyond the extremities of the roots, of sufficient width and depth to allow the process of undermining to be freely carried on. The roots should be gradually set at liberty by a round-pronged fork, the prongs tapering so as to be easily inserted, yet not by any means so sharp as to prick the roots. As the fork is being used, the soil from among the roots will fall into the open trench ; but as it accumulates there it must be cleared away, and, at the same time, the portion of roots set at liberty will require to be slightly tied together with pieces of matting, and, if necessary, supported by temporary stakes, or held to one side by an assistant, while the planter proceeds in liberating others. If there be, as is frequently the case, a tap root extending to a much greater depth than the other roots, and if the latter have been carefully preserved during the operation, the tap root may be dispensed with, for it could only be raised in a mutilated state, owing to the great solidity of the earth at such a depth.

"Although it is very desirable to preserve the greatest possible quantity of sound roots, yet all that are bruised or lacerated should be cleanly amputated up to the sound parts. Cross roots are apt to gall the others when they become large, and therefore the sooner they are removed the better. When the plants are young and in the course of being occasionally removed in a nursing state, all irregularities in the roots should be corrected, which can then be done with comparatively little injury, as the roots of young plants bear a greater proportion to the top than seems to be the case at a more advanced period of growth, and the loss of any of them is consequently felt less. In the early stage of rearing trees, while the proportion of roots predominates, it may be found advisable, in various cases, to shorten, not only the tap root, as above mentioned, but also, judiciously, some of the other strong roots, in order that subdivisions of a more fibrous nature may be produced, and a number of rootlets substituted for large root branches. Even in the case of large trees this principle has been acted upon for centuries, and latterly it has been strongly advocated and put in practice for the purpose of producing immediate effect in park or landscape scenery. A trench is cut out round the tree, and the roots shortened wherever they happen to traverse this trench, so as to leave it quite clear. This being done, the trench is filled up, either with its own excavated soil, or, in very particular cases, with fresh soil The tree has still a sufficient number of undisturbed roots to keep it alive; and, in fact, it ought not to be merely kept alive, but as many roots should be left as will ensure its continuing in a healthy, though not a vigorous state of growth. In the course of a year or two after this operation has been performed, a number of young roots will have been protruded from the various amputations into the loosened soil of the trench; and, partly from the possibility of preserving these roots, and partly from the top becoming habituated to a more limited supply of food, the tree feels comparatively little the change consequent on transplantation.

"Roots may be produced of a proper description for planting by the adoption of such means as the above, and, if care be taken, they will suffer little from the operation of removal. Still, they may be seriously injured from exposure to air, and more especially to drying winds, frost, and even to wet. To be covered in the soil is the natural condition of the roots of most vegetable productions, and, therefore, endeavours should be made to place them in such a condition with the least possible delay; or, at all events, if circumstances render delay unavoidable, such means should be adopted as will preserve them in a state of moisture similar to that which they have in the soil. It is, however, necessary to observe, that when the tops are closely packed up and evaporation from them prevented, the roots should be kept rather dry than otherwise, for, under such circumstances, damp is found to be much more frequently destructive than a little dryness.

"Though the preparatory steps to planting, as regards roots and their preservation, may be properly taken, yet, if the operation be not performed at the proper season, success will not be complete. It is true that instances may be adduced of planting being done at the very opposite season to that which is here recommended as the best; but such cases are only examples of what may be done by extraordinary care in adopting artificial means, so as to imitate more natural circumstances. It is a well-known fact that plants are subject to a process of evaporation from all the parts which are exposed to the atmosphere, provided the latter is not in a state of saturation. The source from whence this evaporation is supplied is the moisture of the soil, and the roots are the media by which it is collected and transmitted to the stem branches and leaves. If the expenditure be greater than the supply of moisture, the plant will begin to suffer ; if the disparity be great and continued, a degree of desiccation will be occasioned sufficient to deprive the vegetable tissue of that moisture which constitutes the medium of intercommunication between the different cells ; organization is destroyed ; the chain which connected it with vitality is broken, and incapable of being reunited by any mechanical means.

"A much greater amount of evaporation takes place from a given surface in some species than in others ; but the amount as regards plants of the same species, all other circumstances being the same, is in proportion to the extent of surface which the respective individuals possess. The leaves of a lime-tree may have a surface equal to thirty times that of the stem, branches, and twigs which produce them, and, consequently, the demand on the roots for the supply of evaporation will be thirty times greater when in leaf than when the branches are naked. Instances might be adduced in which this difference would even be exceeded ; but if, on the contrary, it were found considerably less, still there would be sufficient evidence of the impropriety of moving plants when in leaf; and it may be here remarked that young leaves admit of the fluids being more rapidly evaporated than old ones.

"The month of December is that in which the condition of the air with regard to moisture approaches nearest to that of complete saturation ; and next in this respect is January, which is also the coldest. It might therefore be concluded that these months are the best for planting, more especially as they are the most opposite in character to June and July, which, from their being the hottest and driest, are found to be the worst. But November is also moist ; and although the temperature of the season has not then reached its minimum, yet the foliage, accustomed to exercise its functions under a summer heat, can no longer perform them under a reduction of temperature which, though not the lowest, is comparatively low as regards summer productions. The leaves, in consequence, lose their connexion with the roots ; the earth still retains considerable warmth ; and although the absence of leaves in deciduous trees, and perhaps the inactivity of those of evergreens, may prevent the formation of wood, except in the most limited degree, yet the buds, while they are themselves increased in volume, maintain a corresponding action in the roots, sufficient, in many instances, to form fresh spongioles before winter: a process which is favoured by the soil being warmer than the atmosphere. Should circumstances occur to prevent the actual protrusion of cellular substance in the form of spongioles, still an accumulation of it will be taking place, ready to burst forth in spring. On this account, therefore, although December, January, and February are sufficiently moist, yet November, or as soon as the leaves have fallen, is the preferable season for planting. There may be some exceptions, as in the case of very wet soils, where the plants, if not firmly rooted, are liable to be thrown out during winter, owing to which, spring planting would be more proper ; but, under ordinary circumstances, all deciduous trees will succeed best at the period above indicated. Such species as push forth their buds early ought certainly to be planted in autumn. Many of the coniferous tribe will succeed well if planted soon after they have made their summer's growth; the earth is then warm, and the plants make roots very promptly. Some species of this interesting order of trees require to be planted either before winter, so as to have sufficient time to strike root, or immediately before their buds begin to burst in the spring. These species of trees are injuriously affected by exposure to dry, cold winds, even when their roots are undisturbed by removal; but if planted at a season when several months must elapse before any perfect action can commence, the tops are apt to become dried up in the interval. It appears that if their juices become inspissated to a certain extent, they never again become liquefied, probably owing to their resinous nature.

"The watering of newly-planted trees ought to be attended to. The supply, in the first instance, should be copious, in order to wash the earth into the cavities among the roots. Some err in keeping the roots of newly-planted trees constantly soaked with water, as if they were those of bog plants, for which only such treatment is proper. In watering, consideration should always be had to the nature of the plant; to which, if it delight in dry soils, no more water should be artificially applied than is necessary to moisten it as much as the soil in which the species grows naturally, and at a time when shoots and leaves are abundantly produced. When watering is performed, it should be done thoroughly, so as to reach the lowest portions of the root. In the case of plants being much dried from long carriage or other causes, the supply, on first planting, should be very moderate. The tops, however, should be frequently syringed, in order to moisten the bark, and prevent its absorbing the organizable matter which descends towards the root by the inner bark. The flow must be extremely weak under such circumstances; but if it can be preserved from the effects of drought till it reach the extremities of the roots, the formation of fresh spongioles will immediately commence, and the tree may then be pronounced out of danger.

"The manner of performing the operation of planting may be reduced to one general principle, that of placing the roots in the soil so as to imitate as closely as possible the position which they occupy when growing wild and uncontrolled. Plants, indeed, may be instanced whose roots have been observed, in one situation, penetrating to the depth of four or five feet; or, in another, creeping along the surface, among stones, or into the crevices of rocks, with scarcely soil to cover them, as, for example, in the vine. But although roots can usually accommodate themselves to that position which the nature of the situation renders it alone possible for them to occupy, yet there can be no doubt that in all cases the extremities of the roots should be lower than where they diverge from the stem: a rule which, however self-evident it may be, is frequently violated in practice, by making a basin-shaped hole, deepest in the middle, in which the roots are either doubled, or have their extremities tending upward on the sloping sides of the cavity.

"The excavation for the reception of the roots of a plant should be considerably larger than those roots will traverse when extended at the time of planting. It should be as wide at bottom as at top. The bottom should be more or less convex, and the depth such as to admit of the roots being covered to the extent observed in undisturbed seedling plants of the same species; that is to say, the upper part of the root should only be just covered. The lower roots should be regularly disposed over the convex bottom of the excavation, and carefully strewed with some of the finer portion of soil, over which the other roots may be spread. More soil should then be carefully rather than forcibly introduced. There should be no vacant spaces left, except those of so minute a description that they will be readily filled up by the finer particles of earth washed down by a plentiful watering. This watering should be given when the soil is nearly all filled in, and, after the water has subsided, so as not to stand above the surface, the latter should be covered with the remaining portion of soil. Except in very loose or light soils, this method will supersede the necessity of the hard beating and treading in to which the roots of trees are very generally subjected. The latter practice is now, however, being laid aside by many, from a conviction of its injurious effects. It is also necessary to remark that a plant should be placed, before the introduction of the soil, exactly as it is intended it should stand; and it should not be pulled from side to side for the purpose of shaking the earth among the roots. If the tree be drawn to one side, the fibres of the root will also be drawn towards the same side; but they are, of course, too flexible to force their way back when the tree is drawn in a contrary direction, and they must therefore become more or less doubled. Nor should the soil be thrown *against* the fibres while the roots are being covered; it should be made fine, and either shaken from the spade so as to fall perpendicularly among the roots, or scattered by a force impelling it in the direction of the fibres, which will be, in general, from the stem towards the extremities, or from the centre to the circumference.

"The principles here stated are applicable to the planting of large as well as small trees, and, in fact, to any terrestrial species of plant. There are, however, many modifications in practice, some of which may be noticed as proper under certain circumstances, and others as only to be condemned under any circumstances whatever.

"Small plants are very frequently inserted by the *dibble*, a cylindrical piece of wood, shod with iron, and tapering to a point. This is thrust into the soil, and in the hole formed by this means the roots of the plant are introduced, and a portion of soil passed towards them by a second stroke of the dibble. It is evident, however, that by this procedure the roots cannot be in the most natural position; they are, in fact, the very reverse of being spread out to the best advantage. In the case of very valuable species, the spade or planting trowel is used in preference to the dibble. The latter has nothing to recommend it on the score of good principles in planting; the expedition with which it can be employed is all that can be said in its favour.

"Besides the spade and dibble, various other implements are used in planting, such as the *diamond dibble*, a pointed plate of steel, with a short iron handle; a *mattock*, used in stony soils; and some others, adopted according to circumstances. In all cases, however, where the spade can be used, it is undoubtedly the best instrument. If the soil be unfit for allowing the use of the spade, it should be rendered fit previously; and if some time be lost and expense incurred by using it instead of smaller and more expeditious, but, at the same time, more cramping implements as regards the roots, the difference will certainly be ultimately in favour of a proper disposition of the roots by means of the spade.

"With regard to the preparation of the soil for plantations, it is found that trenching the ground is attended with profit where it is practised for the purpose of rearing wood for fuel and small timber. This mode of preparation ought likewise to be adopted where trees are intended to be planted for ornament or for shelter. It has not been generally attempted in the case of extensive plantations of heath or rugged mountain land. It may, however, be affirmed, without hesitation, that great advantages would be derived from the operation being more extensively performed. Something more than merely burying the roots of hard-wooded plants is thought necessary, and, accordingly, *pits* are made. It is scarcely necessary to observe that, if these are not of considerable size, the direct progress of the roots is soon obstructed. The time required to form these pits as they ought to be would be sufficient to regularly trench double their area. The expense of trenching the intermediate spaces will be compensated by the greater return derived from the nurse plants, such as larch, when they come to be removed.

"Plantations are generally planted thick in the first instance, and with various species of trees. Larch, Scotch fir or pine, mountain ash, &c., are interspersed among the hard wood for shelter, or as nurses. Laburnum is also useful for preserving the other sorts from the depredations of hares, as they prefer the laburnum to every other bark. Nurses are generally left till they are fit for various purposes for which small timber is applicable. They should be planted closer to each other than to the principal trees intended to constitute the more permanent part of the plantation.

"After all the care of the planter, and the skill with which the operation of removing may have been effected, much of the success of a plantation depends on the proper adaptation of species to the soils and situations most suitable to them.

"The following remarks upon some of the timber-trees principally cultivated may be useful:

"The oak (*Quercus robur*, and *Q. sessiliflora*) prefers strong, or even clayey loam; any soil not wet or chalky.

"Beech (*Fagus sylvatica*), calcareous soils, gravelly or sandy loam; dislike stiff clay.

"Elm (*Ulmus campestris*, *U. glabra*, *U. montana*) attains, near the banks of rivers, a large size; thrives in most soils.

"Ash (*Fraxinus excelsior*) prefers a dry subsoil; dislikes stiff clay.

"Plane (*Platanus Orientalis*), rich, warm soil, tolerably moist, but not retentive.

"Sycamore (*Acer pseudo-platanus*, *A. platanoides*), best in moist, deep soil, but will thrive in others not too stiff; withstands the sea-breeze.

"Chestnut (*Castanea vesca*), deep, sandy loam.

"Walnut (*Juglans regia*), deep loam, with a pervious subsoil; dislikes strong clays.

"Hickory (*Carya alba*), similar soil to that required by the walnut.

"Acacia, or locust-tree (*Robinia pseud-acacia*), sandy loam; a sheltered situation; cannot bear storms.

"Birch (*Betula alba*), forms best timber on dry sandy or gravelly soil.

"Laburnum (*Cytisus alpinus*), any soil not too wet.

"White bean (*Pyrus Aria*), any good soil, with a pervious subsoil; dislikes wet clay.

"Lime (*Tilia Europæa*), soft, deep loam, in low, rather moist situations.

"Horse-chestnut (*Æsculus hippocastanum*), deep loam; not in exposed situations.

"Poplar (*Populus alba*, *P. canescens*, *P. nigra*, *P. tremula*, *P. fastigiata*, *P. Græca*, *P. monilifera*). These thrive in almost any soil, but best in that which is deep and rather moist.

"Mountain-ash (*Pyrus aucuparia*), any soil, wet clay excepted; adapted for high situations.

"Alder (*Alnus glutinosa*), moist, or even swampy soil.

"Willow (*Salix*), of numerous species. Some thrive in rather dry soil, but all prefer moist.

"Pine (*Pinus sylvestris*, *P. Laricis*, *P. Pinaster*, *P. Strobus*). The first two are adapted for thin, rocky, gravelly soils; they grow at a great elevation on the warmest sides of mountains, but better in mountain glens; they dislike stiff clay and deep, strong loam, and, like all coniferous plants, they do not thrive on chalk. *P. Pinaster* and *P. Strobus* require a less exposed situation than the other two.

"Spruce (*Abies excelsa*, *A. alba*, *A. rubra*, *A. nigra*), deep, moist soil, in low situations; dislikes thin, sandy soil, and exposure.

"Larch (*Abies Larix*), adapted for thin mountain land, or any soil of which the subsoil is not retentive, excepting, however, red sandstone or chalk, as above mentioned.

"Cedar of Lebanon (*Abies cedrus*),

any tolerably good soil, rather deeper than for the larch, but a pervious subsoil, free from stagnant water.

"Too close planting produces weak, drawn-up timber, in consequence of the tops only receiving a due share of light. It is true that the most magnificent trees are found in those ancient forests that have never been sowed, planted, or thinned by the hand of man; but, at the same time, it will not be denied that, wherever natural forests exist, the soil and situation must be exceedingly favourable for the species produced; and that, although thousands sprung up more than could possibly find room to attain perfection, yet those only that were the most favourably circumstanced and most vigorous would continue; and when once their tops got completely above those of the general mass, the latter must have inevitably fallen into decay. There is no reason, however, to suppose that those which maintained their ground, and, favoured by propitious soil, became lofty specimens, would not have been benefited by the assistance of the axe, to relieve them sooner from their rivals.

"If, on the contrary, trees are planted at too great a distance from each other, they are inclined to ramify into large limbs and spreading tops, with a stem short, but much thicker than where the space admits of less expansion of foliage. If, therefore, very thick timber of no great length be required, wide planting is proper; but if tall timber be the object, the plantation must be moderately thick.

"The care which plantations require from year to year consists in making up deficiencies, thinning, and pruning. Deficiencies seldom occur if the planting be at first duly performed; and every endeavour should be used to prevent the necessity of *making up*. This is always done with considerable disadvantage to the plants thus introduced, unless the spaces be trenched; but in that case, if the species of tree be properly chosen, the plants may do well in consequence of the shelter afforded by the older surrounding individuals.

"Thinning should be commenced in due time. No branch of the temporary trees should, by any means, overhang the top, or even branches of those that are permanent. The shelter on the most exposed sides of the plantation should be formed of robust, vigorous-growing kinds, and it should be allowed to remain unbroken. Plantations that have been neglected till they have formed a dense thicket must be thinned gradually; for if thinned at once, those left would be injured by the sudden exposure, and would be blown over by winds.

"*Pruning* is an important operation in the management of plantations, but it is often improperly practised, for want of the knowledge of a few physiological facts, which are essentially necessary to be stated before any rules for pruning can be properly given. If these facts be understood, few rules will be required, but otherwise a volume of directions are liable to be misapplied. It ought, therefore, to be understood, that the sap ascends from the stem chiefly through the alburnum, or outer layers of young wood. It then enters the leaves, when it is exposed to the influence of light. Having, in consequence, undergone an elaboration, it descends on the outside of the alburnum, that is to say, through the inner bark; the internal surface of the latter possessing a great degree of lubricity, whereby the passage of a portion of the juices, at least, is facilitated to the roots, while part is detained and becomes organized, forming a new layer of woody matter. The thickness of the layer so formed is very different in different species; but in the same species, all other circumstances being the same, it is in proportion to the surface of leaves. The aggregate horizontal growth, or, in other words, the diametrical extension of the stem, branch, and even roots, depends upon the quantity of healthy foliage. The diametrical increase of any particular part corresponds with the greater or less proportion of foliage above that part. Again, it may be stated that if one tree has a clear stem of 20 feet in length, and another has one of 40 feet, the roots and foliage of both being equal, the layer of new wood will be much thinner in the latter case than in the former; for the deposition of woody matter will have to extend over double the surface in the tall tree. It may be also remarked that, in general, if a tree be left entirely to nature, it will ultimately produce a greater bulk of wood, taking stems and branches together, than would be the case if subjected to pruning. Except, however, in the case of growing for fuel, pruning is more or less necessary. The value of a timber-tree depends chiefly on the stem, the branch timber being of less value. The object to be kept in view in pruning for timber is the production of a clean stem with as small a proportion of branches as possible. But it has been explained that the growth of the stem depends on the quantity of foliage, and without branches a sufficient quantity of foliage cannot be maintained. While, on the one hand, an undue preponderance of branches is prevented by pruning, yet, on the other, as much foliage should be preserved as circumstances will permit.

"An excessive privation of foliage should never be occasioned at any one time. It is therefore advisable to commence pruning early, in order, as it were, to repress irregularities in the bud. At all events, whenever an irregularity can be clearly distinguished as such, it should be checked. Thus, when a shoot, occupying the position of a branch, ascends in competition with the top, or leading shoot, and is allowed to go on for years, the stem will have a forked character; or if the competing portion be amputated after it has acquired a large size, the timber will be rendered unsound. But if the shoot from which this aspiring limb took its rise had been stopped in the first or second season of its growth in summer, the tree might have been grown with a clean, regularly tapering stem. It is only great irregularities, however, that should be meddled with during the early growth of the plant; otherwise the increase of roots is prevented, such increase being reciprocal with that of the branches.

"Young shoots of the above description may be checked by being shortened in summer; but no large branches should be cut off at that season, nor after the sap begins to flow briskly in spring. Towards autumn, however, when the leaves have nearly ceased to carry on their functions, pruning may be very properly performed; and some species, for example, the birch and maple, require to be pruned at that time, otherwise they are apt to bleed. The period at which *bleeding*, that is, an extravasation of sap, takes place with greatest force, is immediately before the bursting of the buds in spring. If a branch be cut off when it is in foliage, the remaining portion draws the sap and prevents effusion at the wound. Some derangement will of course be produced in the flow of sap; and a diminution of the process of lignification and of the formation of roots will be occasioned, owing to the abstraction of a certain extent of foliage. But when the sap is in motion, and the leaves at the same time not expanded, the amputation of a branch is followed by a flow of sap, which appears to drain from every part of the tree. The sap becomes stale on exposure to the air; it then affects the cambium and inner bark, often to a considerable extent below the wound, and if these are not in all cases so far completely killed, yet they are generally more or less injured, and canker is apt to ensue.

"Suppose it were required to rear a tree so as to have a stem of clean-grown timber as tall and as thick as could possibly be obtained in any given time. The first consideration is the root, the plant being supposed to be young, with a top or upright leading shoot, and several side branches. All these should be left undisturbed in the first instance, unless such of the latter as may require a check if growing too strong for the others or for the leader. The laterals should be left, for the sake of the roots, till their presence on the stem becomes inconsistent with the object of producing it as free as possible from knots, taking also into consideration that the difficulty in healing the wound increases as the branches get older. A *few* of the largest shoots should be those first removed. They may be shortened in the first instance after midsummer, and afterward cut off smoothly by the lowest circular wrinkles which form round their base, close to the stem, but without slicing off a portion of the bark: a slovenly practice, of which only bad pruners are guilty, and which can only have the effect of diminishing the power of the bark to close over the wound necessarily made by the pruning-knife. Such unnecessary wounds cause an extravasation of sap, as may be seen especially in coniferous trees, where they are generally covered with resinous exudations. In the following season the next largest branches should be in like manner displaced, care being still taken, on account of the importance of the foliage, as already explained, that the quantity removed shall be no more than is absolutely necessary.

"Small branches along the stem should be left till they approach the dimensions by which the removal of the others is regulated. These principles should be followed up till the required height of stem is attained; after which the branches composing the top shall be allowed full freedom, in order to increase, by their organizing power, the diameter of the stem.

"Coniferous trees require little pruning; nor is it necessary to commence so early with them as in the case of other kinds. In dense forests, they are found with straight stems, approaching the height of 100 feet clear of side branches, the latter gradually decaying below as they become excluded from light and moisture by those above them. When, from this cause, the lower branches of coniferous trees are observed to lose, in a great measure, their vigour, and when their foliage contributes little to the enlargement of the stem, they may then be very properly cut off, without waiting for their actual decay. It is a question whether the branches of these trees should be cut close to the stem at once, in pruning, or whether they should first be *snagged*, that is, cut at some distance from the stem, and either allowed so to remain or be afterward cut close. That plan is best to adopt by which the least exudation of resinous substance is occasioned, and the blemish soonest overgrown. With the view of preventing the former, the branch may be shortened only to the first live twigs, so as almost to nullify its connexion with the stem, preparatory to its final and close removal in the following season.

"By choosing the proper season, and by previous shortening, large limbs of any healthy tree may be closely amputated so as to heal over without affecting the tree generally, or even the portion of stem more immediately connected with the limb to any material extent; yet the new layer of wood will prove, on cutting up the timber, to be only in close contact with the surface of the wound, which will remain dead, and with which the living matter enclosing it could not coalesce. A piece of unsound wood is thus imbodied. In this case, it would be advisable to shorten the limb to such of its laterals as will just be sufficient to keep it alive till the tree is felled. If, in the interval, the branch should push vigorously, means must be adopted to keep it always in a reduced state, by merely allowing as much foliage to grow as will keep the branch alive, without affording any material addition to its diameter."—(*Professor Lindley.*)

PLANTING. See *Plantation.* The following table shows the number of plants required for one acre of land, from one foot to twenty-one feet distance from plant to plant.

Distance. Ft.	In.	Number.	Distance. Ft.	In.	Number.
1	0	43,560	8	6	602
1	6	19,360	9	0	538
2	0	10,890	9	6	482
2	6	6,960	10	0	436
3	0	4,840	11	0	361
3	6	3,556	12	0	302
4	0	2,722	13	0	258
4	6	2,151	14	0	223
5	0	1,742	15	0	194
5	6	1,440	16	0	171
6	0	1,210	17	0	151
6	6	1,031	18	0	135
7	0	889	19	0	121
7	6	775	20	0	109
8	0	680	21	0	99

PLANT LICE. See *Aphis*.

PLASHING. "A mode of repairing or making a hedge by bending down a portion of the shoots, cutting them half through near the ground, to render them more pliable, and twisting them among the upright stems, so as to render the whole effective as a fence, and, at the same time, preserve all the branches alive. For this purpose, the branches to be plashed or bent down must not be cut more than half through, in order that a sufficient portion of sap may rise up from the root to keep alive the upper part of the branches. Where hedges are properly formed and kept, they can very seldom require to be plashed; but this mode of treating a hedge is most valuable in the cases of hedges abounding with hedge-row trees, when from neglect, or from any other cause, the hedge has become of irregular growth.

PLASTER. A mixture of burned plaster of Paris with water, which sets with great rapidity, and is used in moulding and the finer work of plasterers.

PLASTER OF PARIS. *Gypsum*, which see.

PLASTIC. Capable of being moulded, adhesive.

PLATBAND. A square moulding, projecting from the wall less than its width.

PLATE. In building, a timber lying horizontally on a wall to receive the ends of girders, joists, rafters, &c.

PLATFORM. A level structure of any materials, to receive a superincumbent building.

PLATINUM, PLATINA. An expensive metal, of the appearance of silver, but very infusible, and of specific gravity 21·5. It resists most chemical reagents, and is used in chemistry for crucibles, and in foil and wire for numerous purposes. The bichloride of platinum, dissolved in alcohol, forms insoluble salts with chloride of potash, or ammonia, but not with soda, and is used to separate the former alkalies from the latter.

PLATYPHYLLUM. The *Katydid*, which see.

PLATYSOMES, PLATYSOMA. A family of coleoptera with wide and flat bodies, living under the bark of trees.

PLEASURE GROUNDS. Grounds laid out in shrubberies, groups of trees, winding walks, and lawns.

PLESIOMORPHISM (from πλησιος, *near*, and μορφη, *form*). A term used to denote a similarity between different crystals in their angles, but not an identity.

PLETHORA. A fulness of the circulatory system, almost amounting to disease, and calling for bleeding.

PLEURA. The serous membrane surrounding the cavity of the chest, lungs, and heart; it consists of two parts, which are united along the middle, and forms the *mediastinum*. Its inflammation is called *pleuritis*, or pleurisy.

PLICIPENNATES, PLICIPENNES. Neuropterous insects, the inferior wings of many of which are larger than the upper pair, and are folded lengthwise, as the caddis flies.

PLINTH. The lowest form or member of the base of a column, of a square figure and small height.

PLIOCENE. The uppermost portion of the tertiary formation, containing recent fossils, for the most part.

PLOTTING. In surveying, laying down on paper the angles and lines measured to calculate the contents of a given tract; it is done with a protracter or plotting scale.

PLOTTING SCALE. "It consists of two graduated ivory scales, one of which is perforated nearly its whole length by a dovetail-shaped groove, for the reception of a sliding piece, to which the second scale is attached, and with which it moves, the edge of the second being always at right angles to the edge of the first. By this means the rectangular co-ordinates of a point are measured at once on the scales, or the position of the point laid down on the plan."—(*Brande's Encyclopædia.*)

PLOUGH AND PLOUGHING. "Before we enter into any details, it may be as well that we describe the different essential parts of a plough by the names which are usually given to them.

"The body of a plough is that part to which all the other parts are attached. The bottom of it is called the *sole*, or *slade*, to the fore part of which is affixed the *point*, or *share*; the hind part of the sole is called the *heel*. The *beam*, which advances forward from the body, serves to keep the plough in its proper direction, and to the end of it are attached the oxen or horses which are employed to draw it. Fixed in the beam, in a vertical position, before the point of the share, with its point a little forward, is the *coulter*, which serves to cut a vertical section in the ground, while the point of the share, expanding into a *fin*, separates a slice by a horizontal cut from the solid ground under it. The *mould-board*, or *turn-furrow*, is placed obliquely behind the fin, to the right or left, in order to push aside and turn over the slice of earth which the coulter and share have cut off: it thus leaves a regular furrow wherever the plough has passed, which furrow is intended to be filled up by the slice cut off from the land by the side of it when the plough returns. The stilts or handles, of which there may be either one or two, as is thought more convenient, direct the plough by keeping it in the line required, and at a regular depth in the ground. The single stilt appears to be the most ancient form.

"Wheels are a modern invention in comparison with the other parts. They support the end of the beam, and prevent it from going too deep into the ground, or rising out of it while the plough is going on. The greatest improvements introduced into modern ploughs are in the shape of the mould-board or turn-furrow, of which we shall take particular notice, and the contrivances for regulating the line of draught, so as to make the plough go at an equal depth, and cut off a regular slice of equal breadth without any great force being applied by the ploughman who holds the stilts.

"The ploughs in use in different countries in Europe have undergone little change for many centuries; it is only lately that any attempt has been made to vary the old forms.

"The Roman plough, such as is described by Virgil in the 'Georgics' (i., 169), is still used in many parts of France, under the name of *Araire Romain*. It consists of a beam (*temo*), a body (*buris*), a share (*vomer*), and a handle or stilt (*stiva*). The office of the turn-furrow is performed by two pieces of wood, about six inches long, projecting obliquely upward, and very properly called teeth (*dentalia*), E F (*Fig.* 1). The sole of the plough, A B, has two pieces of wood, C G and D H, fixed to it on each side, forming an acute angle with it, in which the teeth are inserted. This exactly answers the description of Virgil, 'Duplici aptantur dentalia dorso' (the teeth are fitted to the double back).

Fig. 1.

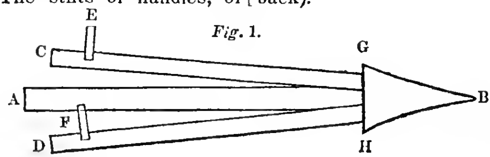
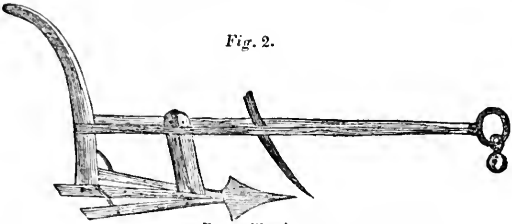


Fig. 2.



Roman Plough.

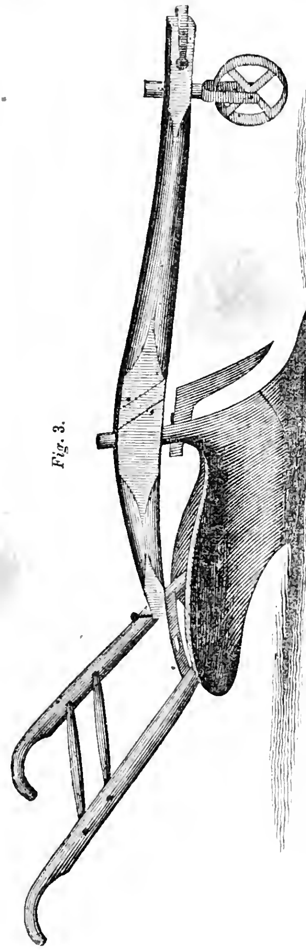
"These teeth help to push aside the earth to the right and left, and the instrument resembles what is called a moulding plough, which is used in throwing the soil aside against young plants growing in rows, as turnips, potatoes, &c. A chain or pole connected with the end of the beam, was hooked to the middle of the yoke on the neck of the oxen, and thus the plough went on making parallel furrows, so near to each other that the preceding furrow was partially filled with the earth which the dentalia pushed aside. The point was in the shape of the head of a lance. This plough might suffice in light, mellow soils which had been long in cultivation, and had more the texture of garden mould than of stubborn clay.

"The small, double mould-board plough, common in other parts of France, is evidently taken from this. The teeth not being sufficiently strong, a slanting board was substituted on each side, and wheels were added, to diminish the labour of the ploughman. The stilt remained the same at the place where it is attached to the plough, but higher up it was divided into two, like a fork, for the convenience of holding it with both hands. This plough acts exactly like the other, but it is stronger and better adapted for heavier land. Neither of them goes much deeper than four or five inches, leaving shallow parallel ridges, in which the seed falls, and is buried by light wooden harrows, which are drawn over the land after sowing. This is an imperfect tillage, the bottoms of the furrows being only partially stirred. The broad, flat share, and the single mould-board, which turns the earth completely over, after lifting it up, is a far more effectual instrument, and has been adopted wherever agriculture has made any improvement. This plough more nearly imitates the digging with a spade, and the more perfect the imitations, the better is the work.

"The mould-board of a modern plough is either fixed on one side, or made to be shifted from one side to the other, or there are two mould-boards, as in Barnaby and Mooer's double mould-board plough, *fig* 3. In the first case, one half the furrow slices lie on one side, and half on the other, and there is of necessity a double furrow where they join. When it is desirable that the surface should be quite flat, and the furrow-slices all in one direction, the mould-board must be shifted at every turn, and a plough which admits of this is called a turn-wrest plough, or there must be two boards.

"The form of the turn-furrow is of material importance, for on this depends not only the perfection of the work, but also the lightness of the draught. When we follow a plough working in a mellow soil which slightly adheres to the plough, we often perceive that, instead of being turned aside, the earth is carried forward, and only falls off when the accumulation of it becomes heavy enough to overcome the adhesion. It does not slide off from the mould-board itself, but separates from the earth which adheres to the latter: thus showing that the shape is defective, and giving good hints for its improvement. But as the same plough will sometimes turn over the same earth better when it is either drier or moister, it is very difficult to determine, by experiment only, what may, on the whole, be the best shape. A little reflection, and the application of scientific principles may greatly assist us here. It is not sufficient, however, to find the curve which will make the plough go through the ground with the least force. The plough must also perform its work perfectly, and if anything is to be sacrificed, it is better to employ more power than to plough the ground badly. After having ascertained the mechanical principles which bear on the working of the plough, we must observe its action carefully, follow the plough day after day, in different soils and different weather, and thus we may be led to observe all the circumstances which attend its operation, and correct any mistakes which an erroneous theory might have led to.

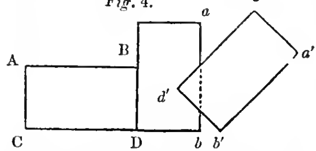
Fig. 3.



Barnaby and Mooer's double mould-board, hill-side plough. It is also furnished with a coulter through the beam. The beam moves readily, so as to come into a line with either mould-board.

"Many attempts have been made to ascertain the exact curve which the turn-furrow should have to perform the work well, and at the same time to produce the least resistance. The difficulty of the problem lies in determining the data, or principles on which the investigation is founded; and these are so various that it is not surprising that no very satisfactory conclusion has yet been obtained. We will make an attempt at a solution from a simple examination of the motion to be produced in the portion of earth to be turned, which we call the furrow-slice. We shall suppose this separated from the adjacent soil by the vertical cut of the coulter, and, at the same time, from the subsoil by the horizontal cut of the share: a section of the slice, by a plane at right angles to the line of the ploughing, will be a parallelogram A B D C (*Fig.* 4), the depth,

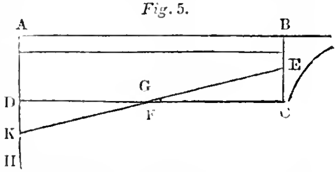
Fig. 4.



A C, being the thickness of the slice, and A B its width. Confining our attention to this section of the slice, the object is to move it from its position, A B D C, as cut off by the coulter and share, to that of $b' d' c' a'$, where it is inclined at an angle of 45° to the horizontal line, the surface, A B ($b' a'$), being laid on the slice previously turned over, so as to bury the grass or weeds which might be rooted there, exposing the roots to the sun and air. The more uniformly this motion is produced, and the more regularly the successive sections follow each other, the less power will be required to turn over the whole slice. The motion of C D round the point D must therefore be uniform. If the turn-furrow is horizontal at the point where it joins the share, and of the same width as the furrow-slice, it will slide under the slice; and if the vertical sections of its upper surface, at equal distances from the share, are inclined at angles regularly increasing with this distance till it arrives at the perpendicular, the turn-furrow will, as it advances, turn the slice from a horizontal to a perpendicular position; the section of it will then be D *c a b*. The inclination of the section of the turn-furrow must now be to the other side, forming an obtuse angle with the section of the sole, until it has pushed the slice over at the required inclination of 45°, which theory and experience have shown to be the best adapted to expose the greatest surface to the action of the atmosphere, and likewise to form the most regular furrows for the reception of the seed, which the harrow can then most readily bury.

"The surface of this turn-furrow is curved in the form of the spiral thread of a screw, such as would be generated by a line moved uniformly forward in a direction at right angles to its length, while it revolved uniformly round one of its extremities. This surface is easily constructed mechanically thus: take a rectangular parallelogram, A B C D (*Fig.* 5),

Fig. 5.



of the width of nine inches, or as wide as the intended furrow, and of a length equal to four times the width. Bisect B C in E, and D C in F; at F raise a perpendicular F G to the plane of the rectangle, and make it equal to C E. Join E G and produce it to K, making F K equal to F E. Join K D. Draw from every point in C D lines at right angles to C D, meeting the line E K in different points: these lines will form the required surface. The line K D will be found inclined 45° to the horizon, at the angle K D H, which is the inclination at which the furrow-slice is most advantageously laid. To those who are not familiar with solid geometry, these lines may be easily exhibited, by means of a wire inserted at E, and bent at a right angle at K,

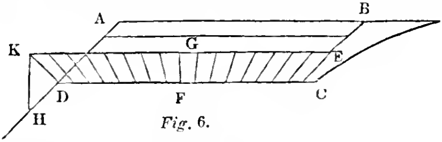


Fig. 6.

inserting the bent portion into the board A B C D (*Fig.* 6) at D, so that it shall be inclined 45° at D, lying in the direction of E K, in *Figs.* 5 and 6. Care must be taken that G F be equal to C E, and perpendicular to the board.

"It is evident that, as the plough moves on, a particle at E will slide along the line E K, become at G perpendicular to the bottom of the turn-furrow, which should be parallel to the sole, and at K be at an angle of 45° with that line. If the slice were a solid substance, this line, E K, would be all that is required to turn it in its proper position; but as the soil is generally loose, and would crumble to pieces, a support must be given to it by a surface at least as wide as the slice. This surface is generated by drawing lines from different parts of D C at right angles to this line, and meeting the line K E (*Fig.* 7). These lines will be at dif-

Horizontal Plan of the Plough.

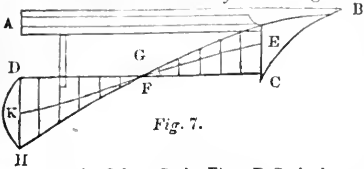


Fig. 7.

A B, the Sole. C, the Fin. D C, the bottom of the Turn-furrow.

ferent angles to the horizon, nearly horizontal at C, where the fin of the point begins, perpendicular at F, and at 45° beyond it at D. The curve thus generated will be found to turn over soils of a moderate tenacity very perfectly. If it is very light, the surface may be formed by arcs of circles with a considerable diameter, the concave part upward; if it is very tenacious, the convex part of the arches may be upward. Thus the surface may be varied without altering the fixed line E K. The annexed figures (8, 9, and 10) will explain this. The distance of the perpendicular F G from the fin of the share may also be varied, either lengthening or shortening the turn-furrow as experience may show to be most advantageous.

Sections of the three different Turn-furrows, at different distances from the Heel.

Fig. 8.

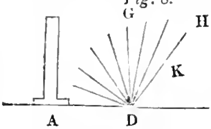


Fig. 9.

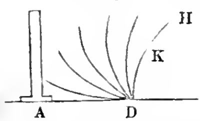
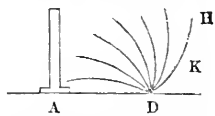


Fig. 10.



"A plough has lately been constructed on this principle; it promises to realize the expectations formed of it. In soils of a loose, mellow nature it answers completely, and does the work more perfectly than any other plough. It unites the parallelism of the sole and bottom of the turn-furrow of the Flemish plough with the improved shape of the turn-furrow. By adopting the variations in the shape of the turn-furrow which we have suggested, this plough may be adapted to any soil, and be used with or without wheels.

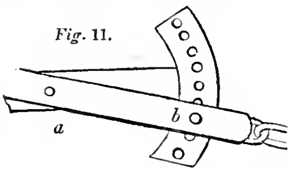
"Ploughs were formerly made of wood, having those parts covered with iron where the greatest friction takes place, the share and coulter only being of iron; but in consequence of the greater facility of casting iron in modern times, most of the parts are now made of this metal. The beam and stilts are still usually of wood, but even these are now sometimes made of wrought iron and cast iron. The advantages of iron are its durability and the smaller friction it occasions when once polished by use. The inconveniences are the additional weight of the instrument, and consequent greater friction of the sole. Recent experiments have proved this to be greater than was generally suspected. A great improvement has been introduced by making the points of the shares of cast iron, which, by a mode of casting the lower surface on a plate of metal, makes one surface much harder than the other; and as the softer surface wears more rapidly, a sharp edge is always preserved.

"The stilts of the plough are mostly of wood. Where the soil is light and crumbling, without stones, a single handle or stilt is sufficient; but where some force is occasionally required to prevent stones or other obstacles from turning the plough out of its course, two stilts are most convenient, placed at a more obtuse angle with the sole of the plough.

"The force required to draw a plough depends, not only on the nature of the soil, but also on the shape of the plough, and especially on the position of its different parts with respect to each other, so that they do not counteract each other.

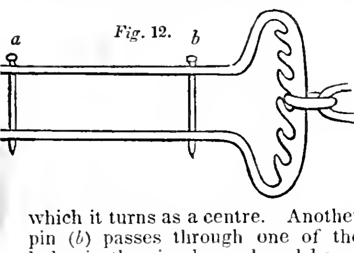
"If a plough were drawn in the direction of the sole, the obliquity of the turn-furrow would cause it to turn towards one side, and it would require a considerable force to keep it straight. In order to prevent this, the line of draught is placed at an angle, which varies with that of the turn-furrow and the force required to push the furrow-slice over. To adjust this angle, so as to cause the plough to keep in the intended line, there is a contrivance at the end of the beam to change the position of the ring by which the plough is drawn to the right or left of the line of the beam, and another by which it may be raised or lowered. In most ploughs the beam, having been originally set at a small angle with the sole towards the right, has an arch of wood or iron at the end, as in the annexed *Fig.* An iron, shaped as in *Fig.* 12,

Fig. 11.



is made to embrace the beam, to which it is attached by a pin (*a*), round

Fig. 12.



which it turns as a centre. Another pin (*b*) passes through one of the holes in the circular end, and keeps the iron in any required position to the right or left of the line of the beam. The end of this iron, which is called a bridle or clevis, has several projecting hooks in the oblong curve which terminates it, on which an iron ring is hung at different heights. By these contrivances the plough may be drawn from a point on either side of the beam, and higher or lower, as may be required. When the plough is found to *take too much land*, as ploughmen say, that is, tends to increase the width of the slice cut off by the coulter, the bridle is shifted to the left by moving the pin (*b*) into another hole; when it goes *out of the land*, as it is called, that is, diminishes the width of the furrow-slice, the pin is moved a hole or two to the right, until the plough has no tendency to deviate to either side. If it inclines to rise out of the ground, the ring is shifted in the iron bridle, and placed in a hook or notch higher up; if, on the contrary, it dips too deep, the ring is hooked lower. Thus a plough may be made to go straight and at a regular depth, without any more force being applied to the stilts than is required to counteract inequalities in the land, or accidental obstacles, such as stones or roots, which might throw the plough out of the ground. When the soil is of unequal texture, it is useful to have a small wheel connected with the fore part of the beam, so as to prevent its dipping downward, which would require a great pressure on the stilts to keep the point of the share up, and thus increase the friction of the sole on the ground, and, consequently, the labour of the horses. In the Rutland plough, two wheels are connected with the beam, one of which runs in the furrow to the right, and the other on the unploughed soil to the left. When the plough has been well adjusted, and the larger wheel runs in the angle of the furrow, it acts as a gauge to regulate the width of the slice, as well as its depth; in very uniform soils without stones, the plough, when set in the proper direction, will make a very straight and even furrow, parallel to the one in which the wheel runs, without any person holding the stilts; so that all that is required is to turn the plough at the end of each furrow, and set it into the proper line to form the next. As this admits of a very correct adjustment, no unnecessary force is required to draw the plough, and hence this plough appears to be the easiest for the horses; and if the wheels are not very heavy, and

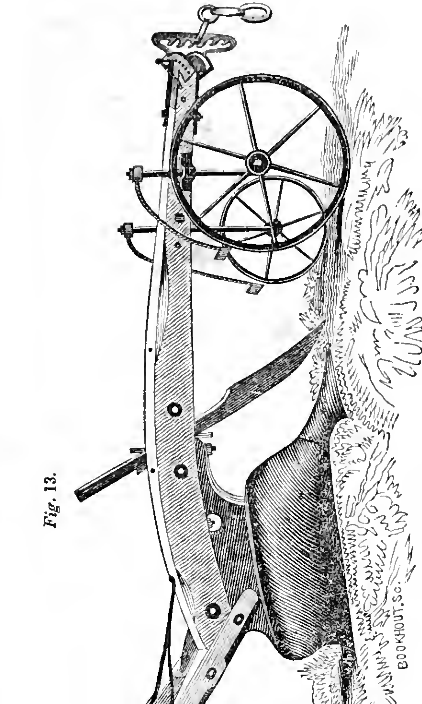


Fig. 13. Ransom's (English) Rutland plough.

the plough is of a good form, it certainly requires less power to move it than many which are without wheels. There are some very irregular and stony soils, where a common swing-plough can scarcely be kept steady without the help of wheels, and where it would not be so convenient to have the beam fixed on the wheels. In this case, a separate carriage is necessary, that the ploughman may have a fulcrum on which he can raise his plough, or turn it to either side to avoid any considerable stone or other obstacle. As a general rule, it may be safely asserted that a slight but strong swing-plough, in the hands of a clever ploughman—with one wheel in particular soils, but, in general, without any wheel—will effect its purpose with the greatest precision, and the least exertion of the horses drawing it. Theory and practice agree in this; and if any experiments appear to throw a doubt upon it, we shall probably find some circumstances which have influenced the result, when wheel-ploughs have appeared to require the least power of draught. But wheels have one advantage—they will enable an inferior ploughman to make better work than he could possibly do without them; and that, too, with less labour to the horses, because, from his want of skill, the swing-plough would be continually subject to sudden deviations, requiring him to use his strength to counteract them; and each exertion of the ploughman adds to the labour of the horses."

The numbers in the following table show the comparative draught of the same ploughs in different soils; they are from Mr. Pusey's experiments:

Trial 1.	Sandy loam . .	$17\frac{3}{4}$	stone.
" 2.	Clay loam . . .	$47\frac{1}{4}$	"
" 3.	Loamy sand . .	$16\frac{1}{2}$	"
" 4.	Strong loam . .	$31\frac{3}{4}$	"
" 5.	Clay loam . . .	$28\frac{3}{4}$	"
" 6.	Moory soil . . .	20	"

"Without entering into any comparison of ploughs differently constructed, it is evident that the shape of the plough must vary with the nature of the soil which it is to turn up. A light soil must be shovelled up; a mellow one may be turned over with any kind of mould-board; a very stiff, tenacious soil, which adheres to any surface pressed against it, will be more easily turned over by a few points of contact which do not allow of adhesion." Where the soil is a stiff, moist clay, the skeleton plough of Finlayson (*Fig.* 14) is drawn with

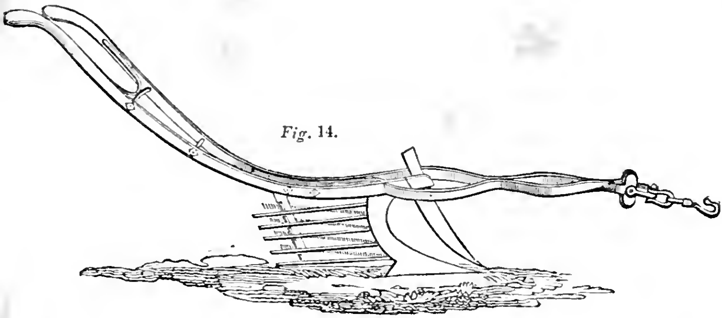


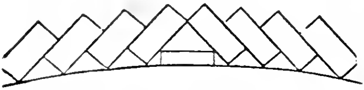
Fig. 14.

half the force necessary for a common implement. This plough is used to some extent in the upper prairie lands, the beam being modified. "Hence the point and turn-furrow have been made of all imaginable shapes, and while one man contends for a very concave form, another will admit of nothing which is not very convex. That plough will, no doubt, have the least draught which is best suited to the soil which it has to move. The lighter the plough is, consistently with sufficient strength, the less draught it requires, all other circumstances remaining the same. Lightness and strength combined are, consequently, great advantages, and if a very light plough does its work as well as a heavier, there can be no doubt that it is preferable. Durability is nothing compared with the saving of one horse in three; it is cheaper to have a new plough every year than to keep an additional horse all the year. If a wooden plough is found to be more easily moved than an iron one, there can be no doubt which should be preferred.

"The Flemish plough is made of wood, and is very light; the share and coulter only are of iron, besides a thin sheet of iron over the mould-board, which is shaped as if it had been rolled obliquely over a cylinder, a shape well adapted to sandy soils. In ploughing land which is more or less mellow and crumbling, the great object is to bring to the surface that portion which has lain buried, and has not served to nourish the preceding crop, and to bury that which has produced vegetation, and in which the roots of various weeds have established themselves. When manure is to be covered with a certain depth of earth, a more complete subversion is required, in order that no part of it may remain uncovered. When the land is in a compact state, from the roots which pervade it, and it is only ploughed once to prepare it for receiving the seed, much greater nicety is required to lay the slices at a certain angle, so as to leave regular lines or depressions in which the seeds may fall and be regularly covered by the harrows which follow.

In this case, the angle of 45° is found to be the most convenient at which the furrow-slices may be laid against one another. The field will then have the appearance of being laid in small ridges, as in the annexed figure,

Fig. 15.



all towards the same side if ploughed with a double mould-board plough, or towards a middle line if a plough with a fixed turn-furrow has been used. To produce this regularity, the end of the turn-furrow is made to press on the slice turned over; and some ploughmen fix a piece of wood or iron to the end of the turn-furrow, which makes a groove in the furrow-slice at the place where the next one will be laid upon it. This prevents useless openings between the slices. It adds, no doubt, to the draught, but it makes better and neater work.

"When the seed is to be dibbled on the sward, which is reversed by a single ploughing, it is necessary that the sod should be completely turned over and laid flat. To do this, and at the same time to bury all the grass, requires the furrows to be very equal and parallel; so that when a roller has gone over the land, it is perfectly flat, without any interstices between the slices which are turned over. It requires a good ploughman to do this perfectly.

"When clover ley or old grass is ploughed up, it is difficult to bury all the grass which grows on the edge of the slice; and if it remains exposed, it will grow and increase, to the detriment of the corn. To prevent this, a wing is sometimes added to the side of the coulter, a few inches from the point. It cuts a small horizontal slice off the surface before the sod is turned over, and this falls into the bottom of the furrow, and is buried there. The coulter with such a wing is called a skim-coulter, because it, as it were, skims the surface (*Figs.* 16 and 17). This instrument may require an ad-

Fig. 16.

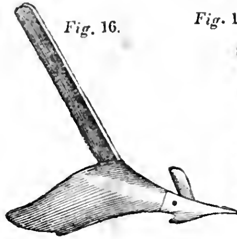
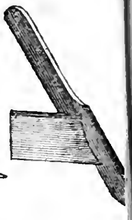


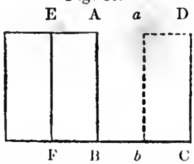
Fig. 17.



ditional horse to be put to the plough in tenacious soils, but this cannot be avoided. There is no doubt that no more horses should be put to a plough than can do the work; but whatever be the number required, the work must be done well. There is no saving in doing the work imperfectly. The discussion about the number of horses which should draw a plough might easily be settled, if the nature of the soil were sufficiently taken into consideration. The shape of the plough may make some difference, but the tenacity of the soil makes a much greater. It is, however, not a little surprising that there should be so little variety in the width of the furrows. It would appear as if there were a law prohibiting furrows less than eight inches wide, or more than ten: a furrow-slice five inches wide and ten deep requires no more power than one ten inches wide and five deep. It is true that a plough will not do more than half an acre at most in a day with narrow furrows; but, if two horses will do this, and two ploughs instead of one be used, with one man and two horses each, an acre will be ploughed in a day with four horses and two men, which is the number usually employed when the furrows are deep and nine or ten inches wide; but the land will be much better stirred, and laid more even. The Romans ploughed with deep, narrow furrows, and varied the width purposely, the better to pulverize the soil. The plough need not be narrower for this work; for if the first furrow be made wide enough, the plough can deepen it by a second turn in it, and a trench is formed in which the next slice falls, and is pushed aside by the tail of the turn-furrows, so as to leave another trench open ten inches wide.

"Suppose A B C D (*Fig.* 18) the section of the first wide furrow, and a slice, A E F B, is cut off the solid side

Fig. 18.



of the land half the width of the trench; the mould-board pushes this earth, after it has been turned over, into the space, D C *a b*, marked with the dotted line, and in doing so beats and crumbles it, leaving a fresh trench, *a b* F E, equal to the first, and so the whole field may be ploughed without difficulty. In nine cases out of ten, where the soil is properly cultivated, and ploughed in a proper state, this mode of ploughing would be found a great improvement, and equal to a trench ploughing, or subsoil ploughing. Where the farms are small, and few horses are kept, deep ploughing is not practicable with the usual width of furrow; but, with a narrow furrow, the land may be moved to a very great depth with a couple of horses. The plough must be made sharp and narrow, and the turn-furrow not much curved, so as rather to push the earth aside than to lift it.

"Very little attention was formerly paid to the straightness of the furrows. It was natural to follow the shape of the boundary of the field, which was seldom straight; and this practice increased gradually till no straight furrow was to be seen; but no curves can be laid so perfectly parallel as two straight lines. Every deviation from parallelism causes a defect in the contact of the slices, and a loss of force by the obliquity of the draught. A superficial observer would not perceive this, but minute examination proves it. Hence equal and straight furrows are a sign of good ploughing.

"When the land lies on a dry subsoil, and no more moisture remains in it, after continued rains, than is useful to promote vegetation, it may be ploughed quite flat. This may be done by a plough with a double mould-board, or by ploughing in a continued spiral from the centre to the circumference, or the reverse. In this case straight furrows cannot be made. The best way is to draw a furrow the whole length of the field in the middle, and plough towards this from both sides. If the field is wide, it is most convenient to plough it into several broad stitches, each a certain number of perches in breadth. A perch ($16\frac{1}{2}$ feet) is a very common width for a stitch, or land, and convenient to guide the sower or the drilling machine.

"But on moist, impervious subsoils it is necessary to lay the land in a rounded form, in order to let the superfluous water run off into furrows, from which it is conducted by proper channels into the ditches. In this case, half a perch is a common width for each stitch, or land. It requires some practice to lay up a land in a rounded form from a flat surface. After cross-ploughing and harrowing, the first furrow is drawn wide and shallow, and the earth is thrown upon the surface to the right: when the plough returns, it takes another furrow about nine or ten inches from the first, laying the earth or furrow-slice somewhat obliquely over the first. At the next turn another slice is laid, meeting the last at an

Fig. 19.

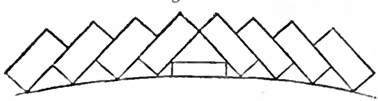
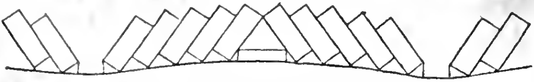


Fig. 20.



angle, the first slice being quite covered by the last two. This now forms the crown of the ridge, and the succeeding slices are laid obliquely, leaning to the right and left, till the required width is obtained. Another land is now begun at the distance of a quarter of a perch from the last furrow, and laid exactly in the same manner. When the two lands meet, the intervening furrow, which had been purposely left shallower, is deepened, and there is a furrow between every two lands, the bottom of which is considerably below the bottom of the other furrows. When this field is ploughed again after harvest, the work is reversed; the furrow between the lands is filled with the first slice, and another is placed over this, which now becomes the crown of the land to be formed: this is called ploughing crown and furrow. When the lands are ploughed towards the crown, it is called gathering. By gathering several times in succession, the soil is much raised at the crown, at the expense of the sides. This was the old practice, when lands were laid very wide and very high; in common fields the land or stitch was often the whole width of the possession, from which came the name of land."

Every practical man will be prepared to understand that the longer his furrows are, the less loss is made in turning; but the amount of this loss is much heavier than will be supposed: according to Stephens, it is,

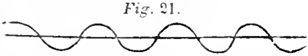
Length of ridge.	Breadth of furrow slice.	Time lost in turning.	Time devoted to ploughing.	Hours of work.
Yards.	*Inches.*	*h. m.*	*h. m.*	*h.*
78	10	5 11	4 4	10
149	—	2 44	7 16	—
200	—	2 1	7 59	—
212	—	1 56½	8 3½	—
274	—	1 28	8 32	—

"One of the most useful operations in ploughing land is to cross the former furrows, by which means the whole soil is much more completely stirred; and if any part has been left solid without being moved by the ploughshare, which is called a balk, it is now necessarily moved. The leaving of balks is a great fault, and is owing to the sole of the plough being narrower than the furrow-slice, and the wing of the point too short, or to the ploughman not holding his plough upright. The share should cut the ground to the whole width of the furrow, that no roots of thistles, docks, or other large weeds may escape and grow up again. Many ploughmen hold the plough in an oblique position; the bottom of the furrow is consequently not level, and the soil is not stirred equally. This is a great fault, especially in wet ground; for the furrows thus become channels, in which the water remains, not being able to run over the inequalities of the bottom. It is of no use to lay the surface convex if the solid earth below lies in hollows or gutters. The water naturally sinks down into the newly-ploughed land, till it meets the solid bottom which the plough has gone over; if it can run over this into the deeper furrows between the stitches, it evaporates or runs off, and the land is left dry, and so consolidated as to let the water run along the surface without sinking to any depth; but if the bottom is uneven, it remains in the hollows, and stagnates there, to the great injury of the growing crops.

"There are various modes of ploughing land when it is intended to pulverize and expose it to the sun in summer, or the frost in winter, to purify and fertilize it. To expose as great a surface as possible, the whole field is laid in high and narrow ridges, bringing to the surface all the fertile portion of the soil, and often, also, a portion of the subsoil, so as to deepen the productive portion, and give more room for the roots to spread in. The simplest method of increasing the surface exposed, when the land is first broken up from pasture, or after having been some years in grass, and is in a foul state, is called *ribbing*. The plough turns up a slice, which it lays over flat on the adjoining surface. It does not cover this with the next slice, as if it were beginning the crown of a stitch, but it takes another slice at some distance, and then one parallel to the first, likewise laid flat on the solid part. When the whole field has been so ploughed, the surface consists altogether of ridges and furrows, but only half the surface has been ploughed. No grass appears; if it has been well done, the unploughed strips being covered by the slices raised by the sides of them, the two surfaces with grass on them cover each other. It is left in this state till the grass is rotten, and when the sod is broken to pieces by heavy drag harrows, the land can be cross-ploughed and cleaned or fallowed in dry weather.

"There is another mode of *ridging*, when the land has had one or two ploughings, in order to expose it to the frost in winter, and to mellow it. The operation is somewhat similar to ribbing, but after the first slice is turned over, another is added, as deep as the plough can be made to go so as not to bring up the subsoil; by this means the whole surface is laid in high ridges and deep furrows; and

Fig. 21.



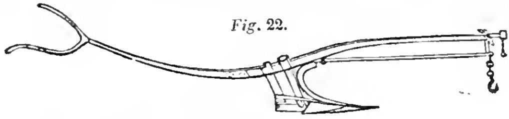
when this ploughing is reversed in spring, the soil which has been exposed to the frost and wind is mixed with the rest, and tends greatly to mellow it. This is an excellent preparation for potatoes and roots, if the land has been well cleaned. The manure, being distributed in the deep furrows, is covered by the plough right and left, or at one operation by a plough with a turn-furrow on each side, which divides the ridge and lays half of it in each contiguous furrow. The plough is a double mould-board plough, which is extremely useful in many operations of husbandry.

"In order to save hands and expedite the tillage of the land, ploughs have been contrived which make two or more furrows at once. When they are well constructed, they are very useful on light soils. If it is not required to go deep, and two horses can draw a double plough, there is a decided saving of power; but if it requires four horses, nothing is gained. The double ploughs are therefore not much in use. But there are instruments which cultivate the earth, stirring and pulverizing it much more speedily than the plough. Some of these will stir the ground to the depth of seven or eight inches, going over a width of five or six feet at once. Such an instrument is preferable to the plough, after the ground has already had a certain degree of stirring, and is become mellow and crumbling; but to break up pasture or clover ley there is nothing so efficacious as the plough, which cuts regular slices, and lays them over so that all the grass shall rot, and the roots, being exposed to the air, shall decay, and thus furnish food for other crops.

"The instruments which have been invented to save the time and labour required by repeated ploughings are very numerous. Some of the most useful have been noticed before (see *Arable Land.*) New ones are daily invented, and some are supported by wheels, which render them both lighter and more convenient. They are easily raised out of the ground, when not intended to work, and the depth to which they are let down is more easily regulated.

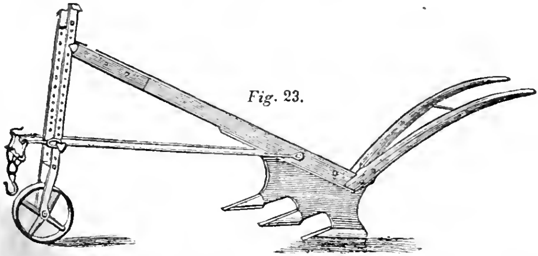
"Deep ploughing is generally acknowledged to accord with the best husbandry, where the subsoil is dry naturally, or has been artificially drained; but some inconvenience may arise from bringing a barren subsoil to the surface, in trench-ploughing, by two ploughs following each other in the same furrow. It has therefore been suggested to take off the turn-furrow from the plough which follows the first, so as to stir the subsoil without bringing it to the surface. This idea has been improved upon by constructing a subsoil plough of great strength, which will go very deep into the ground, and stir the subsoil a foot or more below the bottom of the usual furrow. Mr. Smith, of Deanstone, has invented one made entirely of iron (*Fig.* 22). This plough requires four horses in the most favourable soils, and six in tenacious clays, to keep up with the common plough, which always should precede it. Many improvements have been made on Mr. Smith's original implement; that represented in *Figure* 23 is one of the best; the three

Fig. 22.



Smith's Subsoil Plough.

Fig. 23.

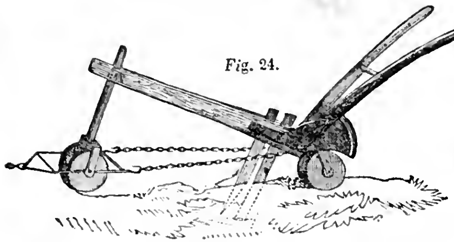


points cut down the earth gradually, and pulverize it thoroughly. Sometimes, however, the subsoil plough may be used alone, where the surface is already mellow and crumbling.

"Many different ploughs have been invented for the purpose of saving labour in draining land. See *Draining Plough*. As they all cut out a slice from the bottom of a furrow, and raise it up to the surface of the ground, they are of little use in crumbling soils, and in the most tenacious require the assistance of much manual labour to complete the work. They act on the principle of the carpenter's tool, by which a groove is formed in the edge of planks or deals, when they are intended to be joined closely, as in a floor. This instrument is also called a plough; but the uniform tenacity of the wood allows a narrow chisel to cut an even, regular groove. In the draining plough the two sides of the drain are to be cut obliquely downward and the bottom scooped out evenly. The plough requires to be often adjusted, and the deep furrows to be kept cleared from loose earth by means of spades and scoops. In this way drains may be made from fifteen to eighteen inches deep, in which loose stones or tiles may be laid to form a channel for the water. The expense is much less than when the drains are made with the spade.

"When grass land lies low and wet on a very tenacious subsoil, a plough is sometimes used which consists of a cylinder of iron pointed at one end, and connected with a strong beam by a thick plate of iron, which is sharp on the side nearest the point of the cylinder, and acts as a coulter. This instrument is forcibly drawn horizontally through the stiff subsoil at a depth of twelve to eighteen inches, so as to leave a round channel like a pipe where the cylinder has passed. This has been called a mole plough, the passage made by it under ground resembling the workings of a mole. It takes six horses to draw this plough when the cylinder is fif-

Fig. 24.



Lambert's Mole Plough.

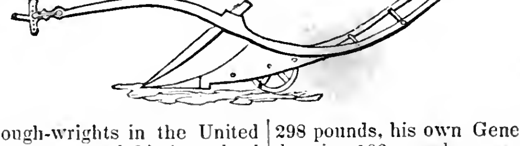
teen inches under the surface, but is the most easy and expeditious means of temporarily draining land. It can only be done when the soil is moist and gives way without cracking, but at that time the feet of the horses greatly damage the surface. In consequence of this, a windlass with a long chain has been invented. The drum, which is vertical, and round which the chain is coiled, is turned by a horse, who walks round and round, while the whole apparatus is kept in its place by means of an anchor fixed in the ground. It draws the mole plough the length of the chain, and is then moved forward on small wheels while the chain uncoils. As soon as the chain is all off the drum, the anchor is refixed, and the operation continues. This mode of draining land has now been almost entirely superseded by a more regular and permanent system of draining with stones or tiles. The channels made by the mole plough are very apt to fill up in dry weather; and the mole takes advantage of a ready-made passage to work in it, stopping it purposely to retain water and to form its nest. When this is the case, the water rises to the surface and does much harm. Nothing but a fresh application of the mole plough parallel to the old channels can remedy this evil.

"Various ploughs have been constructed with the intention of diminishing the draught, or improving the form of the turn-furrow; but most of them without much regard to scientific principles, merely from a vague notion founded on some real or supposed defect in the ploughs in common use, or in order to adapt them to particular soils and situations."

Of late, some have favoured the idea that the introduction of a wheel in the heel of the plough would diminish the draught by converting a sliding into a rolling friction. The figure, from Mr. Wilkie's implement, will explain the mechanism (*Fig.* 25). In a public trial it was found to diminish the draught thirty per cent.

Burrell, of Geneva, New-York, and

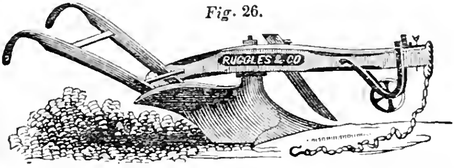
Fig. 25.



other plough-wrights in the United States, have patented friction-wheel ploughs; and in the case of Burrell's shell-wheel plough, the draught by the dynamometer, at the New-York Agricultural Society's Fair, 1843, was 298 pounds, his own Geneva plough drawing 100 pounds more.

Draught.—It is the custom at the fairs of several agricultural associations, to have a trial of ploughs with the dynamometer, whereby their comparative draught is in some measure ascertained. We are not, however, to regard these as absolute quantities; they are true only for the time. The adhesiveness of the soil, its state of moisture, the depth of the furrow, its width, and the pace of the horses, are all sources of disturbance. Thus we find, by comparing the different results with the same implement, that the Bergen plough, at Sing Sing, drew 472 pounds, and the next year, at Patterson, 350 pounds. The same difference is seen in other cases: how little these experiments can be taken as a guide, appears from the fact that ploughs, which at one season were lowest on the list, take the prize the next year. From these experiments we gather, however, two important facts, viz., that a two-horse plough ought not to weigh more than 170 pounds, nor require, in a medium soil, more than 450 pounds draught, these numbers being the average results of the better kind of implements. The length and sharpness of a plough have much to do with its draught; but it is properly urged by practical men, that such ploughs become difficult to manage in rough lands or new fields, the leverage of the body being too great. It is in this respect that American ploughs differ so strikingly from Scotch and English implements: they have a mellow, clean soil to till, we a rough, stumpy soil. The accompanying figure gives a good general outline of our best class of ploughs. It is not, however, a good representation of Ruggles, Nourse, and Mason's implements.

Fig. 26.



It would be very invidious to state that any particular machine was the best; nor is it true, for, as is justly remarked by Mr. Rham, the figure of the plough must differ with the soil, and that is a bad one in any soil which either drags too heavily on the horses, or does not fully tax their power. In a list I procured from Washington of ploughs, I find 164 patented since 1831. Of these, there are marked by Mr. Ellsworth as being good, in his knowledge and experience, Deat's, Moore's, Prouty and Mear's. Woodcock's, John Mear's; and of my knowledge I can recommend Barnaby and Mooer's, Delano's, Bergen's, Ruggles and Co's. centre draught, the Wisconsin, Codding's American, Howard's, Eastman's, of Baltimore, the Caledonia, Livingston County, the iron beam, Burrell's Geneva and shell-wheel ploughs, the Montgomery County plough, and the Scotch wrought-iron plough. The editor of Johnson's Encyclopædia also mentions Beech's, Miles's, Peacock's, and Wiley's ploughs, besides which there are numerous excellent implements in the West and elsewhere.

Wiard, of Avon, Thorp, and other instrument makers, have placed three or four small ploughs on a frame, so as to run as many furrows; in light sand soils, and for an after ploughing, these may answer; but if we have to hitch on additional horses, there is little gain. The shares of Langdon's cultivators are in some measure of the figure of mould-boards.

The table on the following page will be found useful in showing the distance travelled by a horse in ploughing or scarifying an acre of land; as well as the quantity of land worked in a day, at the rate of sixteen and eighteen miles per day of nine hours.

Breadth of Furrow-slice or Scarifier.	Space travelled in ploughing an acre.	Extent ploughed per day, at the rate of		Breadth of Furrow-slice or Scarifier.	Space travelled in ploughing an acre.	Extent ploughed per day, at the rate of	
Inches.	Miles.	18 Miles. Acres.	16 Miles. Acres.	Inches.	Miles.	18 Miles. Acres.	16 Miles. Acres.
7	14 1/8	1 1/4	1 1/8	46	2 1-6	8 1/3	7 2-5
8	12 1/4	1 1/2	1 1/4	47	2 1-10	8	7 3-5
9	11	1 3 5	1 1/2	48	2 1 12	8 3/4	7 3/4
10	9 9-10	1 4 5	1 3-5	49	2	8 9 10	7 9-10
11	9	2	1 3/4	50	2	9 9 10	8 1-10
12	8 1/4	2 1-5	1 9 10	51	1 9-10	9 1-5	8 1/4
13	7 1/2	2 1/3	2 1-10	52	1 9-10	9 1/2	8 2 5
14	7	2 1/2	2 1/4	53	1 9 10	9 3/4	8 1/2
15	6 1/2	2 3/4	2 2-5	54	1 4-5	9 4-5	8 9-10
16	6 1-6	2 9-10	2 3-5	55	1 4-5	10	8
17	5 3/4	3 1-10	2 3/4	56	1 3/4	10 1/4	9
18	5 1/2	3 1/4	2 9-10	57	1 3/4	10 2-5	9 1-5
19	5 1/4	3 1/2	3 1 10	58	1 7-10	10 3-5	9 1/3
20	4 9-10	3 3-5	3 1/4	59	1 7-10	10 3/4	9 1/2
21	4 7-10	3 4-5	3 1/3	60	1 3-5	10 9-10	9 7-10
22	4 1/2	4	3 1/2	61	1 3-5	11 1-5	9 4-5
23	4 1/4	4 1-5	3 7-10	62	1 3-5	11 1/3	10
24	4	4 1/3	3 9-10	63	1 3 5	11 1/2	10 1-5
25	4	4 1/2	4	64	1 1/2	11 7-10	10 1/3
26	3 4 5	4 3/4	4 1-5	65	1 1/2	11 4-5	10 1/2
27	3 3-5	4 9-10	4 1/3	66	1 1/3	12	10 3 5
28	3 1/2	5 1/8	4 1/2	67	1 1/3	12 1/4	10 4-5
29	3 1/2	5 1/4	4 3-5	68	1 1/2	12 2-5	11
30	3 1/3	5 3/4	4 4-5	69	1 2-5	12 3-5	11 1/8
31	3 1-5	5	5	70	1 2-5	12 3/4	11 1/3
32	3 1-10	5 4-5	5 1/4	71	1 2-5	12 9 10	11 1/2
33	3	6	5 1/3	72	1 2-5	13 1/8	11 3-5
34	2 9-10	6 1-5	5 1/2	73	1 1/3	13 1/3	11 4 5
35	2 4 5	6 1/3	5 3-5	74	1 1/2	13 1/2	12
36	2 3/4	6 1/2	5 4-5	75	1 1/3	13 3 5	12 1/8
37	2 2/3	6 1/4	6	76	1 3 10	13 4-5	12 1/4
38	2 3-5	6 9-10	6 1/8	77	1 3 10	14	12 1/3
39	2 1/2	7 1/8	6 1/3	78	1 1/4	14 1/4	12 3-5
40	2 1/2	7 1/4	6 1/2	79	1 1/4	14 2-5	12 3/4
41	2 2 5	7 3/4	6 3/4	80	1 1/4	14 3-5	12 9-10
42	2 1/3	7	6 2-3	81	1 1-5	14 3/4	13 1-10
43	2 3-10	7 4-5	7	82	1 1 5	15	13 1/4
44	2	8	7 1-10	83	1 1-5	15 1/8	13 2-5
45	2 1-5	8 1-6	7 1/4	84	1 1-6	15 1/3	13 3-5

PLOUGHING. See *Plough.*

PLUG. "In building, a piece of wood driven horizontally into a wall, its end being then sawn away flush with the wall, to afford a hold for the nailing up of dressings."

PLUM. *Prunus domestica.* The improved fruit: the following excellent observations are chiefly from Mr. Thomas:

Varieties. — "*White Primordian, Early Yellow*, or *Jaune Hative*, is one of the very earliest of plums, ripening in the middle of July, and is chiefly valuable on this account. It is a small yellow fruit, a good bearer, with a sweet taste, though not first-rate.

"*Wilmot's Early Orleans.*—This is a large, fine fruit, ripening early in August.

"*Greengage.* — This is generally admitted to be the finest of all plums; the fruit is of medium size, and round; the skin is yellowish green, when fully ripe nearly yellow, *mottled* with russety red near the stem; flesh melting, and of exquisite flavour. There are many varieties cultivated in this state under the name of greengage, which appear to have originated from stones of the genuine variety, but are greatly inferior in flavour.

"*Prince's Imperial Gage* was obtained from the seed of the greengage; the fruit is much larger than that of the greengage, and the tree is very productive. Manning says that this is 'the most productive and profitable of all plums.'

"*Orleans.* — Fruit nearly round, middle-sized or rather large, skin reddish purple, flesh yellow, firm, and good, separating freely from the stone. An excellent fruit, ripening about the time of the greengage.

"*Gifford's La Fayette* was obtained from the seed of the Orleans, and is an excellent fruit, remarkable for the richness and sprightliness of its flavour.

"*Huling's Superb.* — Fruit very large, often two inches or more in length, not inferior in richness, but more acid than the greengage, of very vigorous growth, and of extraordinary excellence.

"*Washington.*—Fruit oblong, very large, orange yellow, with a fine blush next the sun; flesh yellow, firm, sweet, and excellent. Though the flavour of this is inferior to that of some other varieties, it is highly esteemed as a first-rate plum. Ripens about a week later than the Orleans.

"*Imperatrice.* — A good plum, ripening in October. One of the best late plums.

"*Coe's Golden Drop.*—Fruit of large size, skin golden yellow, spotted with rich red next the sun, flesh yellow, sweet, and delicious. Like the preceding, slightly necked next the stem, a clingstone, and a great bearer. The best late plum. The writer has measured them more than 2¼ inches long.

"*The Egg Plum,* or *Yellow Magnum Bonum,* is a very large plum, of a sweet, agreeable flavour; but, as the texture is rather coarse, is chiefly used for cooking and preserving. The same remark applies to the *Red Magnum Bonum,* which is harsh and acid. These two are admired as table-fruit where finer varieties are unknown.

"The plum is propagated by budding or grafting. The former can only be successfully practised on the most thrifty stocks.

"The principal enemy to the plum is the *Curculio* (*Rhynchænus pruni*). This is a small insect with an elongated thorax and head, which resembles a proboscis in appearance. The whole insect is not more than a quarter of an inch long, of a dark brown colour, the sheaths covering the wings, slightly variegated with lighter colours. It makes a small incision in the young fruit, and lays its egg in the opening. Its presence may now be perceived by examination, as these crescent-shaped incisions are very easily seen. The egg soon hatches into a small white worm, which penetrates deeper and feeds upon the fruit, causing it to fall prematurely to the ground, or if it ripens, it is unsound. The worm, when the fruit falls, makes its way into the earth, where it remains through winter, as is supposed, in the pupa state, to be transformed the succeeding spring into a perfect insect, and thus perpetuate its race. The easiest and most effectual way to destroy them is to confine a sufficient number of swine with the trees, to eat all the injured fruit which falls. When this has been pursued perseveringly, it has proved completely successful. To render this operation easy and effectual, all trees which are liable to attacks of the curculio should be planted separately, so that they may be enclosed apart for the confinement of the swine.

"Another remedy is to spread white sheets under the tree and jar it briskly. The insects immediately drop upon the sheet, and remain motionless a few seconds, during which time they may be destroyed. The operation should be repeated two or three times a day so long as any remain. This remedy rarely fails if thoroughly and unremittingly pursued.

"Trees near path doors, paved yards, and other frequented places, are frequently observed to be full of fruit, while others are all destroyed. Hence favourite trees of the plum, nectarine, or apricot may be often planted to advantage near such frequented places, and the fruit will escape. The black excrescences on the branches of the plum may be prevented by a constant and vigorous excision of the affected parts, and burning them as fast as they appear.

"The plum is by some cultivators regarded as only fitted for heavy or clay soils, and some striking instances are given in proof; but the writer has seen trees in abundant bearing year after year, and yielding fruit of the finest quality, on light or sandy soils. A porous earth may possibly furnish a better retreat for the curculio; but to what extent this may be true requires farther examination."

The plum is often brought into bearing by root pruning, horizontal training, and similar expedients. The lime compost used by Mr. Pell is very serviceable.

PLUMBAGO. Native carburet of iron; black-lead.

PLUMULA. The leaf-like portion of the embryo.

PLUS. More: marked by the sign +

PLUTONIC ROCKS. Unstratified crystalline rocks, like granite, porphyry, basalt.

PLUVIAMETER. The rain gauge.

PNEUMATICS. The science which treats of the mechanical characters of gases and vapours.

PNEUMATIC TROUGH. A chemical utensil used for the collection of gases over water or fluids. It consists of a vessel of tin or wood containing water, in which is placed one or more ledges, within two inches of the surface. On the ledges the jars which are to receive the gases rest, and they are at first filled with the fluid of the trough, but the gas passing up into them from conductors, the fluid is displaced.

PNEUMONIA. Inflammation of the substance of the lungs.

PNEUMO-THORAX. A collection of air in the cavity of the pleura.

POA. An extensive genus of valuable natural grasses, to which the meadow grass, blue grass, and many important species belong. The botanical characters of this genus are, *panicle* loose; *spikelets* three or more flowered, or even two-flowered, with the pedicels of a greater number of florets; florets articulated with the rachis; *paleæ* two, nearly equal, awnless; *scales* oval, acute, gibbous at the base. See *Grasses*.

POACHING. The treading of cattle in wet meadows, in which they leave their hoof marks.

POCKET. A large bag of hops.

POD. Those of the pea and bean are called *legumes;* those of the radish, mustard, and cruciferæ are *siliques*.

PODENTIA. The stalk which supports the fructification of some lichens, as the reindeer moss.

PODICEPS. A genus of palmipedine birds, in which the web of the foot is not perfect.

POIKILITIC. Variegated. In geology, the new red sandstone formation.

POINTS OF LIVE STOCK. "The first *point* to be ascertained in examining an ox is the *purity* of its breed, whatever that breed may be. The ascertainment of the purity of the breed will give the degree of the disposition to fatten in the individuals of that breed. The purity of the breed may be ascertained from several marks. The colour or colours of the skin of a pure breed of cattle, whatever those colours are, are always definite. The colour of the bald skin on the nose and around the eyes in a pure breed is always definite and without spots. This last is an essential *point*. When horns exist, they should be smooth, small, tapering, and sharp-pointed, long or short, according to the breed, and of a white colour throughout in some breeds, and tipped with black in others. The shape of the horn is a less essential point than the colour.

"The second *point* to be ascertained in an ox is the form of its carcass. It is found, the nearer the section of the carcass of a fat ox, taken longitudinally vertical, transversely vertical, and horizontally, approaches to the figure of a parallelogram, the greater quantity of flesh will it carry within the same measurement.

"These constitute the *points* which are essential to a *fat* ox, and which it is the business of the judge to know, and by which he must anticipate whether the lean one, when fed, would realize. The remaining points are more applicable in judging of a lean than a fat ox.

"The first of the *points* in judging of a *lean* ox is the nature of the *bone*. A round, thick bone indicates both a slow feeder and an inferior description of flesh. A flat bone, when seen on a side view, and narrow when viewed either from behind or before the animal, indicates the opposite properties of a round bone. The whole bones in the carcass should bear a small proportion in bulk and weight to the flesh, the bone being only required as a support to the flesh.

"A full, clear, calm, and prominent eye is another *point* to be considered, because it is a nice indication of good breeding. It is always attendant on fine bone.

"The state of the skin is the next *point* to be ascertained. The skin affords what is technically and emphatically called the *touch*, a criterion second to none in judging of the feeding properties of an ox. The touch may be good or bad, fine or harsh, or, as it is often termed, hard or mellow. A perfect touch will be found with a thick, loose skin, floating, as it were, on a layer of soft fat, yielding to the least pressure, and springing back towards the fingers like a piece of soft, thick chamois leather, and covered with thick, glossy, soft hair."

POINTS OF SUPPORT. The foundations, walls, or pillars of a building, whereon the superstructure is founded.

POINTS OF THE COMPASS. See *Compass*.

POISON FANGS. The hollow teeth in the upper jaws of vipers, rattlesnakes, &c., through which their poison is discharged into the wounds they make. Only such snakes as have poison fangs are venomous.

POISON OAK. *Rhus radicans*, and *R. toxicodendron*, the former being also called poison vine: it is a climber, the stem throwing out an abundance of black roots. The milky juice is poisonous, and, to some persons, the volatile particles thrown off from the plant. They produce inflammation and swelling, resembling erisypelas. Light diet, laxatives, and a lotion of sugar of lead and water to the part are best.

POISONS. Bodies which disturb or destroy the natural functions of the body. They are narcotic, acrid or septic. Many are to be met by antidotes; but with animals the stomach pump is to be looked to as the chief means of relief.

POITTEVIN'S MANURE. Night soil mixed with fine charcoal and dried to powder. 12 to 25 bushels are applied, with the seed, by a drill, to the acre.

POLARITY. The quality in the particles of bodies of adjusting themselves in given directions, as north and south, in the magnet.

POLARIZATION OF LIGHT. "Light which has undergone certain reflections or refractions, or been subjected to the action of material bodies in any one of the great number of ways, acquires a certain modification, in consequence of which it no longer presents the same phenomena of reflection and transmission as light which has not been subjected to such action. This modification is termed the polarization of light, its rays being supposed, according to particular theoretical views, to have acquired poles (like the magnet), or sides with opposite properties."—(*Brande.*)

POLDERS. The old salt marshes of Holland and Flanders.

POLE. A rod. 16½ feet.

POLECAT. *Skunk?* (*Felis Putorius*, Lin.) "It may be caught and destroyed by a deadfall, constructed in the following manner: Take a square piece of wood, weighing 40 or 50 pounds, bore a hole in the middle of the upper side, and set a crooked hook fast in it; then set four forked stakes fast in the ground, and lay two sticks across, on which sticks lay a long staff, to hold the deadfall up to the crook; and under this crook put a short stick, and fasten a line to it; this line must reach down to the bridge below; and this bridge you must make about five or six inches broad; on both sides of this deadfall place boards or pales, or edge it with close rods, and make it 10 or 12 inches high; let the entrance be no wider than the breadth of the deadfall. A pigeon-house surrounded with a wet ditch will tend to preserve the pigeons, for beasts of prey naturally avoid water."

POLE EVIL. See *Ox, Diseases of.*

POLES. The ends of the wires proceeding from a galvanic battery;

the extremities of a magnet. There are two poles, north and south, or positive and negative. They are also called anode and cathode by Mr. Faraday.

POLLARD. Bran. Also, a tree often cut or lopped for hoops, firewood, &c.

POLLED. Hornless.

POLLEN. The yellow dust or farina of the stamens or male organs. It fertilizes the pistils. The pollen is thrown out by the bursting of the anthers, and alighting on the moist and acid surface of the stigma, begins to throw out a little tube, or pollen tube (*boyau*), which pierces the tissue of the stigma, and reaches the ovule, where it lays the foundation of the embryo. Without pollen, seeds would not be formed capable of germination; and in wet seasons a large amount is often destroyed.

POLY (from *πολυς*, *many*). A prefix of many words, as polygon, polypetalous.

POLYCHROITE. The colouring matter of saffron.

POLYGAMIA, POLYANDRIA. See *Botany*.

POLYGASTRIC INFUSORIALS. The class of animalcules with many stomachs inhabiting infusions.

POLYGONACEÆ. Herbaceous, apetalous exogens, with triangular, scaly fruit, and an ochrea. The rhubarbs, sorrels, docks, and buckwheat belong to this family.

POLYPES, POLYPI (from *πολυς*, and *πους*, *a foot*). The name of an extensive group of radiated animals in the system of Cuvier, associated together by the common character of a fleshy body, of a conical or cylindrical form, commonly fixed by one extremity, and with the mouth situated at the opposite end, and surrounded by more or less numerous arms or tentacles.

POLYPODY, POLYPODIUM. Several species of handsome ferns.

POLYPUS. A fleshy tumour of the nostrils or womb. It is to be removed by the knife with care.

POMACE, POMAGE. Refuse apples, after pressing for cider. It is excellent food for cows and hogs, especially if fresh.

POMACEÆ. Rosaceous plants. with an inferior ovary, as the apple, pear.

POMEGRANATE. *Punica granatum*. A beautiful, hardy, deciduous shrub, growing from 12 to 15 feet high. Its varieties produce their splendid flowers and fruit very plentifully from July to September, when planted against a south wall. They all grow well in a light, rich loam, and strike root freely from cuttings or layers; the rarer varieties are sometimes increased by grafting on the common kinds. The pomegranate requires shelter from frost. The pulp of the fruit is of an agreeable acid, and the rind is very astringent.

POMMEL. The front prominence of the saddle.

POND. "An artificial excavation in the soil, or a natural hollow, dammed up for the purpose of detaining water, generally made in fields, in order to supply drink to pasturing animals. The essential difference between a pond and a lake is, that the former is formed by art, the water being often ponded, or impounded, by a bank of earth thrown across a natural hollow or bourne containing a stream. The soil should be puddled, to render it impervious, before water is let in. In places where the soil does not abound in springs, the formation of ponds in the fields is as essential to the business of farming as the building of farm offices. A pond in a garden, when of a round form, is termed a basin; and when of some length, with parallel sides, a canal."

PONE, PONES OF BREAD. Small loaves.

PONS VAROLII. An eminence of the medulla oblongata, at the top of the spinal marrow.

PONTIA. The genus of insects to which the cabbage butterfly belongs.

POPLAR. The genus *Populus* of amentaceous exogens. They prefer a moist, deep, and good soil, and are readily increased by cuttings. The wood of the *P. monilifera* is very good when thoroughly dried, and not exposed to moisture. The tulip-tree is improperly called a poplar.

POPLITEAL. Relating to the space behind the knee joint.

POPPY. The genus *Papaver*, of which the *P. somniferum* is cultivated for opium and the bland oil furnished by expression from its seeds. It is cultivated on the best soil, well manured. The land sometimes receives as many as five stirrings, and the seed is then dropped into shallow drills, about two feet apart. During the growth of the plants, the soil is stirred, well watered, and sometimes top-dressed. In two months from the time of sowing, the capsules are ready for incision, which process goes on for two or three weeks; several horizontal cuts being made in the capsule on one day, on the next the milky juice which had oozed out, being congealed, is scraped off. This operation is generally repeated three times on each capsule, and then the capsules are collected for their seed. The raw juice is kneaded with water, evaporated in the sun, mixed with a little poppy oil, and, lastly, formed into cakes, which are covered with leaves of poppy, and packed in chests with poppy husks and leaves.

The *P. Rheas* is also cultivated as an oil plant in France, where little of the opium is made. In Europe some species are a great pest in cornfields.

POPULIN. A crystalline substance obtained from the bark of the aspen.

PORCATE. In entomology, divided into ridges; a surface on which there are several elevated and parallel grooves.

PORCELAIN CAPSULES. Evaporating basins of porcelain; this material resists a great heat, and is not readily acted on except by potash or soda.

PORCH. An arched or flat ceiled vestibule to a door or building.

PORES. Small spaces existing between the atoms of bodies; also, distinct apertures through leaves or membranes, from which perspiration and vapours pass.

POROSITY. The property of bodies whereby they transmit fluids or gasses, and which depends on their pores.

PORK. See *Bacon, Ham, Hog.*

PORK, CLEAR. Side pork for barrelling, free from lean, being all fat; the Berkshires, if fully fat, cut as large a quantity as any other breed.

PORPHYRY. A hard red or gray stone of the nature of granite, of igneous origin, and consisting of feldspar, with quartz or hornblende It occurs in the oldest dikes.

PORRECT. Extending. When a part extends horizontally.

PORRIGO. Scald head, ringworm, tetter. Tar ointment, cleanliness, and attention to the general health, are the best remedies.

PORTAL. The lesser of two gates.

PORTAL CIRCULATION. The circulation of venous blood from the abdominal viscera through the liver to the right auricle of the heart.

PORTER. A beer coloured with dark malt or molasses.

PORTICO. A projection from a building, supported by arches or pillars.

POSITIVE ELECTRICITY. See *Electricity*. A surplus of electricity.

POST. A perpendicular piece of timber; a piece driven into the earth; the end should be charred. Locust, catalpa, and oak posts are preferred.

POST ABDOMEN. The five posterior segments of the abdomen of insects, or the tails of some crustaceans.

POTASH, POTASSA, KALI. Protoxide of potassium, a well-known caustic (vegetable caustic). See *Potassium*.

POTASHES. The washed or lixiviated ashes of trees, especially of oaks, hickories, maples, sycamores, the elm, willow, and beech. The ash, mixed with lime, is leached in barrels or vats, and the clear solution, being drawn off, or allowed to drip from holes made in the bottom of the vats, is next evaporated in large iron pots set in a furnace: these are kept full several days. When the fluid becomes black and of the consistence of thick molasses, it is subjected to the highest heat of a wood fire for some hours; by this means much of the combustible matter is burned. As soon as the fused matter becomes quiet it is dipped out by iron ladles into iron pots, where it congeals; this, broken into pieces and barrelled, forms commercial potash. The lye should be sufficiently strong to bear an egg before being evaporated. Pearlash is made by transferring the black potash into a reverberatory furnace, and stirring it while hot: this is continued until it acquires a whitish colour.

Composition. — American potash consists of 85·7 parts caustic potassa, 15·4 sulphate of potassa, 2·0 common salt, 11·9 carbonic acid and water, and 0·2 insoluble matter in 115 parts. Pearlash contains 75·4 caustic potash, 8·0 sulphate, 0·4 common salt, 30·8 carbonic acid and water, 0 6 insoluble matter in 115 parts.

Amount of pure potash in 1000 lbs. of wood: in elm and maple, 3·9 lbs.; willow, 2·8 lbs.; oak and beech, 1½ lbs.; poplar, ¾ lb.: the spray and young branches are richest in ashes. The varieties of pine seldom furnish half a pound to the 1000 of timber.

POTASSIUM. The metallic basis of potash; it is white and brilliant, but soft as wax, lighter than water, sp. gr. ·86, and spontaneously inflammable on water; symbol, K.; proportional, 39·3. Its compound with 1 equivalent oxygen, potash, is one of the most important chemical agents: a powerful base and an alkali.

Potash is very soluble in water, neutralizes acids, discharges the colour of red litmus, converting it into blue; it is also soluble in alcohol. It unites definitely with water, forming the hydrate, or fused potash, containing 47·3 potash, and 9 parts water. Potash combines with nearly all acids; by the agency of heat it also dissolves silica, being converted into silicate of potash. Its prominent salts are the nitrate, carbonate, sulphate, and muriate (chloride of potassium).

In the mineral kingdom it exists abundantly, forming 10 to 20 per cent. of many minerals, as mica, feldspar, lava, and green sand. In these it is insoluble, and in the form of silicate; but it becomes slowly dissolved by water containing carbonic acid. In plants it is also abundant, especially in the grasses and cerealia; the vine, oak, willows, maples, cruciferous and chenopodiaceous plants contain a considerable proportion. It is found in urine, and in other animal excretions.

POTATO (*Solanum tuberosum*, Linnæus). *Varieties:* "Of the better kinds, we may enumerate the following:

"1. Kidneys, or Foxites, white flesh, rather small, and seemingly deteriorating, as an old variety.

"2. Pink Eyes, white flesh, rather kidney-shaped, yield well, and are yet in their prime.

"3. St. Helena, very similar in flesh, shape, colour, and quality to the foregoing, without the pink eyes or blotches: to us a new variety.

"4. Early Kidneys, real kidney-shaped, smooth, white, and of fair size: the best early variety.

"5. Mercer, well-known and deservedly liked.

"6. Sault St. Marie: the true kind large, long, dark-coloured, and good.

"7. Liverpool Blues: coloured, good size, and productive. Boil white, and may be placed in the first class for the table.

"The foregoing we esteem the best kinds. There may be other kinds equally good, and some that we have enumerated may be known by other names. The Forty-fold has been highly commended for its productiveness and good qualities, with what truth we will not venture to say.

"In this latitude the potato is better, both as to product and flavour, when grown on a moist and cool, than when grown on a warm and dry soil; better on a moderately loose and friable than on a hard, compact soil.

"They do better on a grass ley than on stubble; and better with long or unfermented manure than with short muck.

"The medium-sized whole tubers give a better crop than sets or very large tubers.

"Drills or rows should be adapted to the growth of the tops, and the condition of the soil—the small growing tops nearer, and those having larger tops, farther apart, so that the sun may not be excluded from the intervals; and where the soil is stiff, or the sod tough, hills are considered preferable to drills.

"If the ground is well prepared, and the seed well covered, they are not benefited by heavy earthing; ploughing among them, or earthing them, after they come in bloom, *is* prejudicial.

"The kinds best for the table are also best for farm stock, containing a larger portion of nutriment than inferior kinds."

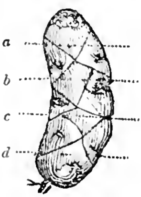
"Those who are curious about obtaining new varieties can almost indefinitely pursue their object; for the seed of a species, the red apple, for example, will sport, and this, too, without hybridizing (that is, without the admixture of its pollen with that of any other species, the produce of which would be hybrids), into numberless varieties of form and colour—round, flat, oblong, red, pink, black, white, mixed, and purple, of every shade and colour. These, whether hybrids or not, are reproduced through successive seasons by the tubers alone, if they possess those qualities which render them desirable for continued cultivation, on account of peculiar adaptation to early or late seasons, size, predominance of farina, &c.

"This mode of propagation by tubers either improves those qualities or gradually develops objectionable properties; some varieties are therefore permanently established, while the culture of others is either abandoned, or, if continued, it is known that those varieties revert, in the course of a few generations, to the nature of their parent kind, and therefore cease to constitute a variety.

"In the vegetable kingdom, hybrid plants have not the power of propagation by seed; but they can be rendered reproductive by budding and grafting, or by means of cuttings, slips, and tubers, and an original stock, comparatively worthless, may be highly improved by such modes of multiplication. But when a farmer possesses two or three kinds of decided excellence, he will act wisely by not encumbering his stores with too many varieties, which always occasion trouble and confusion in the field management.

"In order to obtain seed, properly so called, the potato-apple, when perfectly ripe, should be dried, and then disengaged from its seed by rubbing with the hand. The seed should be preserved in a dry place, in paper or cloth bags, until the middle of March or beginning of April, when it may be sown in wooden boxes or earthen pans, with a covering of less than half an inch of well-pulverized earth; the vessels ought then to be placed in hot-beds of mild heat, such as is suited to the raising of half-hardy annuals. The plants, when an inch high, should be pricked out into other vessels, and placed in a temperature somewhat lower than before, to inure them to the external air, to which they should be exposed after frosts have ceased. These plants should be put out in drills 16 inches apart, and with the interval of six inches between the plants in the rows; they will produce tubers in the first year, and these may be planted in the following season in the ordinary way.

"For very early crops, such as those which the ash-leaved and walnut-leaved kinds, in particular, yield, the most successful treatment was that practised by the late Mr. Knight, president of the London Horticultural Society, from the course of whose practice we give the following details of instruction: Drills may be formed in a warm and sheltered situation (and in the direction of north and south) during any of the winter months, two feet apart, and seven or eight inches deep. Stable dung, half decomposed, should be laid in the drills, and combined with the earth four inches downward, and covered with some of the mould which had been thrown out in forming the drills, by the rake, to within four inches of the surface. The sets, uncut, are then to be placed, with the crown eye uppermost, in the centre of the furrow, four inches from each other, and to be covered with only an inch of mould at first, and afterward with an occasional quantity of sifted coal ashes, until the plants are so vigorous and advanced as to require the usual earthing, of which, however, very little is necessary. Mr. Knight used leaves as a lining at the sides of the drills in the early periods, to preserve as much warmth as possible, and better to guard against the effects of frost. The sets near the top end (*Fig.*, *a*) are found to come to maturity a fortnight earlier than those at the root end (*d*); and these, therefore, form two classes of sets for an earlier and a later crop. The sets from the middle (*b*, *c*) are put together for an intermediate crop.



"This management alone will be found successful, except, perhaps, in very tenacious clay soil, in which the rains of winter may lodge so near the fibres of the plants as to destroy them altogether; but destruction from this cause may easily be avoided by increasing the original depth of the furrows and loosening the bed of clay below with the spade to such a depth as will allow the water to descend from the surface, with a drain to carry it off altogether; or by laying below some absorbent matter, such as ashes, chalk, or calcareous gravel.

"The germination of the sets may be accelerated by a little management previously to their being planted, by laying them on a floor, sprinkling them with water until they bud, and then covering them with finely-sifted mould. If this be done early in January, the sets, with strong shoots, may be taken up in April (with as much earth as possible adhering to them), and carefully placed in the drills prepared as directed, and covered with well-rotted leaves or earth in the same way.

"To market gardeners it is a great object to raise the earliest potatoes, considering the high price which they obtain for them, though in their waxy state they are neither wholesome nor palatable. Next in early maturity to the ash-leaved and walnut-leaved are the early manly and early champion, and Fox's seedling.

"The best soil for potatoes generally is that which is altogether fresh from the state of ley, or which has not long been broken up: land which has been in grass for only two or three years is easily prepared for the principal crop. It should be as deeply ploughed as possible before winter, and early in April harrowed, and thoroughly cross-ploughed. After lying in this state for two or three weeks, it should again be well harrowed and very deeply ploughed twice, without bringing up any bad substratum, and it will then be fit for the reception of the crop.

"The most approved modes of setting are as follows: Drills should be formed in the well-pulverized field, with double boutings of the plough, in order to have the shoulders uniform, which is essential to the correctness of succeeding operations. The dung is then to be carted out, and divided by the carter with a drag fork, as his horse and cart move forward (the horse walking in the centre of three drills, while the wheels move in the other two), in such quantities as can be most conveniently shaken out into the drills by the labourers employed to spread it. In dry weather the carting does no injury, and this method is universal in Scotland. The other principal mode, more generally pursued in Ireland by some of the best cultivators of the potato, i to cart out the manure before the drills are formed, in rows seven or eight yards apart, and to supply the drills from the heaps as the plough advances in its work, reserving just as much as is supposed sufficient for the concluding drills, which are to be made in the sections of the field previously occupied by the rows of manure. By the latter treatment the manure may be laid over the sets, which cannot be done in the former case, and this will preserve them from being displaced or crushed by the feet of the horses during the process of covering the seed. But against this advantage, which is not inconsiderable, there is the inconvenience of calculating with precision and laying aside, as the plough advances to draw the last drills—where the rows had stood—the precise complement of manure, and the difficulty to the ploughman of preserving the exact breadth in those drills.

"Some avoid any perplexities in those respects by ploughing in the manure thoroughly before drilling, and either dropping the set in every third furrow, or rolling the whole manured and ploughed surface, and then making drills. Our own experience is greatly in favour of this latter mode, when the fertilizing matter is abundant and of the short description, which freely combines with the soil, and does not obstruct the plough in the subsequent drilling. The lazy-bed method is so generally condemned that any explanation of it here would be superfluous, yet in undrained bog land, or under any circumstances in which a redundancy of wetness is probable in the autumn, as on low, marshy lands, or stiff clay soils which have no sufficient inclination to carry off the water, and are likely to be saturated with moisture in winter, from want of drainage, the lazy-bed system is by far the safest. The deep, wide furrows at each side carry off the water, or, at least, remove it from the potato. Thousands of tons of potatoes, in the year 1839, were utterly lost in Ireland, being drilled in flat and tenacious lands, which would have escaped destruction from the continued rains of that season if drained by the furrow of the lazy-bed. Besides, where circumstances preclude the practicability of deep ploughing, the lazy-bed practice, repeated for three years, will completely spade-trench the entire land, and thus effect an important benefit, not otherwise attainable by the humble tiller of the soil, who has no teams for ploughing it effectually. Thus local or national modes, though apparently defective to the superficial observer, are sometimes founded upon sound principles; and though we feel disposed to exclude the minute details of what is only defensible under peculiar circumstances from an essay on potato culture under our modern system, we protest against the unqualified condemnation of a method which is still pursued throughout nearly one half of Ireland.

"The sets (uncut, for reasons to be yet assigned) are next to be laid down, either under or over the manure, at the average distance of sixteen inches, by the setters, who move in a retrograde direction, and are provided with aprons to contain the sets. A sufficient number of men is in attendance to divide the manure evenly in the drills; the plough also is in the field, in order that there may be the least possible exposure of the manure and sets to the sun or to parching wind, but the plough should cover the sets rather lightly in clay soil.

"The roller is next used to lay an even surface to the young plants, and to facilitate the subsequent progress of the paring plough, which is to be set to work when the stems are six or seven inches high, and should move as close to the plants as is practicable without injuring their tender fibres. The weeders should then hoe the plants carefully, and immediately afterward (for the influence of wind or hot air on the roots is pernicious) the scuffler or drill-harrow is to follow, in order to clean and level the intervals, before the earthing-plough, with either double or single mould-board, is introduced to apply fresh earth to the stems.

"Such is the method of earthing universally pursued by the farmer in Ireland and Scotland, but in England the hand hoe is principally used for destroying weeds, loosening the earth, and moulding the plants; for the first two of these operations the bean hoe (which cuts about six inches deep) is used, and the turnip hoe for drawing the earth to the stems. One man will hoe out the weeds and loosen the soil of half an acre per day, and the subsequent earthing of the same quantity is also executed by one man. This is far cheaper than horse work, and it does no injury to any of the stems, and makes no waste land at the head-riggs; and where the earth has been perfectly well prepared at the commencement, this manual husbandry is the best.

"As to the distance between the drills, due regard must be had to the natural quality of the soil, and the quantity and description of manure available, or, in other words, to the probable luxuriance of foliage. Mr. Knight, aware of the necessity of allowing room in proportion to the vigour and height of the plants, has laid down an exact rule, thus: 'The height of the stems being three feet, the rows ought to be four feet apart;' but for a general average thirty inches is the best distance. As to excess of foliage, we are certain that it is not desirable, for the produce of tubers is not always in proportion to the degree of foliage; under high and rank stems there is often a very scanty crop, and Mr. Knight is justified by experience in his observation that 'the largest produce will be obtained from varieties of rather early habits and rather low stature, there being in very tall plants much time lost in conveying the nutriment from the soil to the leaves,' and consequently strong and upright stems, which do not fall down and shade the others, are those which are desirable.

"Two more earthings are usually given, but it is questionable whether even one be necessary in soil of average depth. unless there be a very wide interval between the drills, and it is certain that much earthing in dry and shallow soil is injurious; for by withdrawing the earth from contiguity to the fibres which ramify and penetrate far in loose soil, and laying it on the head of the drill, and in the high ridgelet form, it is applied where it is useless for the nourishment of the tubers, and in a position that favours the rapid escape of moisture, which, in such soil, it ought to be an object to retain. In deep land, more particularly if it be of tenacious quality, the furrows at each side of the drill will be, in general seasons, most serviceable as drains, as well as for furnishing earth to support the stems, while the moisture will be sufficiently retained for the roots.

"Experiments have led to the inference that, in soil of a loose, porous quality, there is probably a greater produce by not affording any (or a very slight) moulding, but by digging, instead, between the rows; for deep and perfect pulverization, next to an adequate allowance of rich manure, is the main cause of a large produce. In proportion to the deficiency of manure will be the necessity for opening the soil beneath, to allow the fibres, which may be distinctly traced to a depth incredible to those who have not followed their ramifications, to extract all the nourishment which the subsoil may afford. If there be an abundance of nutriment above, neither the necessity nor, perhaps, the inclination for penetrating deeply can exist, and in such cases the operation of earthing by the plough, as long as it can be introduced without injury to the stems, may be useful in many ways, but unquestionably by guarding them from the effects of storm in exposed, and from excessive wetness in low situations; besides, in regulating this point, regard should always be had to the quality of the potato, for the tubers of some varieties have a tendency to push to the surface, while others tend into the earth, and therefore require a different treatment.

"But in all cases the earth should be rendered as loose and friable as possible, by spade, hoe,* or plough, and where labour is easily commanded, the spade will be found to be the more efficacious implement in the first course of treatment, after the plants are well up.

"Some plant one or two sets in the centre of every square yard, but in such cases great and continued earthing, until each square presents the form of a pyramid, is contemplated; and, if our preceding remarks be correct, this treatment is only applicable to deep and retentive soils. Great returns have, no doubt, been thus obtained, but by this mode there is the least possible incorporation of the manure with the soil.

"In minute husbandry, such as that exemplified in labourers' allotments, which excludes the plough altogether, the ordinary and best practice is to lay the sets in rows, after a very deep winter digging, marked with a garden-line. The workmen digs precisely as in a garden plot for cabbages: he clears a little drill, lays the sets straight, puts a sufficiency of manure over them, and then covers from the next spit, which he digs with a spade or a three-pronged fork flattened at the ends, levelling and pulverizing as he advances to the distance at which he again puts down his line and forms a new drill. Thus the entire piece is thoroughly loosened, the manure perfectly covered, and every facility given for the hand-hoeing in due course.

"The next stage of the potato is that in which it blossoms. It has been recommended to pluck off the flowers. Excessive blossoming is no doubt injurious, but experience has generally proved that the extra cost is hardly defrayed by the additional produce obtained. If the flowers are plucked off, they should be nipped in the early bud.

"When the crop is fully ripe, which is indicated by the withering of the stalks, and when the land is free from stones, labourers, in the proportion of about twenty to one plough (half of these being usually men, and the remainder women or young persons), should be set to pull up the stalks, and carefully collect the tubers which may be attached to them before the plough proceeds in its operation. When it is prepared for work, the men, with prongs flattened at the extremity, are placed at such distances from each other as will give them proper time to fork out the potatoes cleanly for the pickers, who are also stationed at exact distances with a basket between every pair, into which they gather the potatoes.

"The common swing plough may be employed in three ways: First, in taking off a slice from each side of every drill, and leaving it to the workmen to open out the centre with their prongs; or, in its third movement, it may turn up this centre, under which the main body of the tubers lie, which is more expeditiously and easily done if the earth be in fit condition. Second, a double mould-board plough with a long sack, and divested of its coulter, may be drawn by two strong horses through the centre of the drills, and completely under the level of the tubers, so as to avoid injuring them, by which means the work-people will be kept exceedingly busy; and if the land be in good friable order, this is the most expeditious mode; and provided there is a perfect harrowing afterward, the crop will be taken out with sufficient cleanliness. Third, the crop may be taken up by prongs, or long, narrow spades, without the plough. In wet weather, this more tedious, but far safer method is frequently adopted; and if the drill be short and the head-riggs under crop also, it is the most desirable, effectual, and economical mode. In removing the produce in this manner, it is obvious that the number of gatherers should be much less, in proportion to the men, than under the other circumstances. The head-riggs should evidently be the first parts of the field cleared, to make

* That kind called the bean hoe, shaped like an adze.

a free space for the ploughs in the boutings and for the carts.

"One horse will answer for three carts, if the distance of draught to the pits be short, by changing him alternately from an empty to a full one, but this only applies to the Scotch and Irish system of draught by single carts and horses. The general mode of securing the crop in pits in the field is the safest. In making the pits—improperly so termed, for the base is only sunk a few inches, and the potatoes are raised considerably in the heaps—the only caution to be observed is, that furrows should be cut on all sides to prevent water from lodging or penetrating inward, and that the earth thrown up and over them, to the depth of four or five inches, should be well beaten with spade or shovel to exclude moisture and frost. The potato stalks, however apparently dry, should never be laid between the potatoes and the earth in these accumulations, for they soon ferment and rot, and injure all the potatoes in contact with them. Straw is at least useless. The length of the pit depends on circumstances, but the breadth should not exceed four feet, as large accumulations are most liable to fermentations."

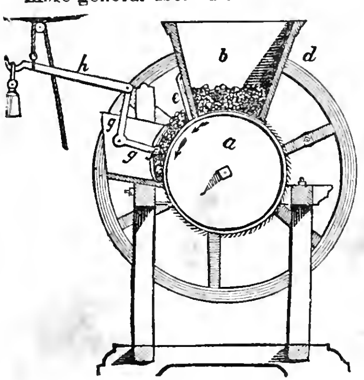
The potato crop is commonly below 200 bushels the acre, but by good management 400 bushels may be obtained.

"The only decided diseases of the potato, besides the dry rot, is 'the curl,' which is an imperfect formation; and a rot of the new tubers, which seems to be owing to a fungus, and may be overcome by liming or using salt to the land. One thing, however, is clear, that from a crop of which any part is intended for seed, all the plants affected with curl should be carefully separated before the general removal commences. The dry rot, or decay of the set, is also still unexplained as to its real cause, though the press has teemed with essays and very plausible theories respecting it. The same malady was remarked for many years, and, we have reason to think, in seasons similar to those which we have experienced in latter years. The set, though apparently sound when planted, has either failed to germinate at all, and rotted away, or has feebly and partially thrown out its sickly shoots. The most contradictory causes have been assigned: over-ripening in the preceding year; under-ripening; fermentation in the pits; fermentation of the set in the ground when placed in contact with hot dung (which is utterly absurd, for when in the ground no injurious fermentation can arise); very hot weather, great drought, hot sun, cold, parching wind, dry and heating manure, sea-ware, which is always damp; exhaustion of the kind from a long course of culture, contradicted by many instances, in which it appears that the produce of the same variety—for instance, the apple—has been successively cultivated during sixty-five years without any failure; or the loss of vitality from prematurely shooting.

"If potatoes have fermented in their accumulated state, they would bear obvious evidence of it, and therefore be rejected. Fermentation cannot be the true cause in every or even the majority of cases, nor does the failure, probably, proceed from insects in the eyes, as has been suggested; for if so, it is difficult to account for the fact that sets from the same heap planted at one part of the day have totally failed, while others put into the ground at another have pushed forth healthy shoots. As to decay in the land, from the contiguity of fermenting manure, How is it to be proved that the gases evolved by fermenting manure can injure the sets? Fermenting manures would rather stimulate by their warmth, and excite their growth by the aliment which their essential qualities, carbon and ammonia, supply to plants. Why do not the gaseous exhalations from rank and fermenting hot-beds destroy the tender plants which are raised in them?'

"The same causes which are severally assigned for the total or partial failure of the potato in numberless instances, and to a most distressing extent in Ireland, have existed since the culture of the potato commenced, but without the effects deplored, which have only prevailed within a very recent space of time. But from the frequent and searching investigation of the subject by the most competent and practical men, a preventive against the failure has been ascertained, namely, the planting of entire tubers. When cut sets have failed, the entire tubers have resisted premature decay; whether it arises from atmospheric influence or debility of constitution, or from any of the conjectured causes, the entire tubers resist these noxious influences, and germinate healthily and freely. All reports agree on this point: there is no risk in this case, if the tubers be sound when planted; and it may be added, that in all stages of their growth, the uncut tubers maintain a decided superiority and yield a corresponding produce.

"The farina of the potato, properly granulated and dried, is sold in our shops as tapioca, to which it bears the closest resemblance both in appearance and essential properties. For confectionery, the flour is so delicately white, and it is so digestible and nutritious, that it ought to be in more general use. Few housewives are ignorant of the method of obtaining it by the use of a common hand-grater and sieve; but for yielding larger supplies, some machinery is necessary. The preceding figure represents an approved implement: *b* is the hopper; the potatoes are scraped by the wires set in the revolving wheel *a*."



Manures for the Potato.—Lime is eminently serviceable in improving the mealiness and flavour of the potato; salt, at the rate of five bushels the acre, is also an invaluable manure; but all gross animal composts are injurious, many of them rendering the tubers waxy and of bad flavour. The fresh potato contains 75 per cent. water; 1000 pounds in the ordinary state yield 8·28 pounds ashes. The composition of the ash is, by Sprengel,

	1000 lbs. tubers.	1000 lbs. tops
Potash and soda	6·36	8·29
Lime and magnesia	·65	14·67
Phosphoric acid	·40	1·97
Sulphuric acid	·54	0·42
Silica	·08	4·94
Chlorine	·16	0·50
Iron, alumina, &c.	·08	0·06
	8·17	30·85

This analysis also explains why plaster is sometimes useful in composts intended for the potato. A light soil abounding in humus is most profitable for this crop.

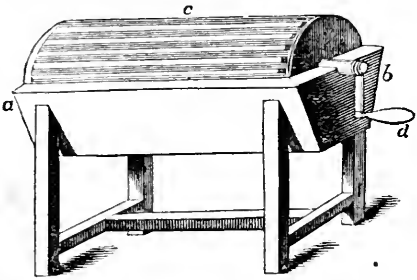
POTATO FLY. See *Blistering Fly.*

POTATO PIES, CAMPS, or PITS. See *Potato* and *Barrow.* Earthen mounds to store potatoes and other roots.

POTATO STARCH. The farina. See *Potato.*

POTATO SUGAR. The sugar produced from potatoes by boiling potato starch with sulphuric acid. It is *glucose.* See *Sugar.*

POTATO WASHER. The figure on the following page represents a simple and effective implement. It consists of a trough containing water, on which is made to revolve a cylindrical cage (*c*) containing the potatoes. The cage opens to allow the tubers to be introduced and withdrawn.



POTS FOR PLANTS. The common unglazed earthen pots are superior to those that are glazed, because they allow excess of fluid to drain off by their pores. The size should be proportional to the plants.

POT-STONE. A tough soap-stone.

POTTER'S CLAY. Plastic clay either of a white or red colour.

POTTING. The placing of young plants in small pots for the following purposes:

"The first and greatest end attained by potting is the power of moving plants about from place to place without injury; green-house plants from the open air to the house, and the reverse; hardy species, difficult to transplant, to their final stations in the open ground without disturbing their roots; annuals raised in heat to the open borders, and so on: and when this power of moving plants is wanted, pots afford the only means of doing so. It also cramps the roots, diminishes the tendency to form leaves, and increases the disposition to flower. Another object is to effect a secure and constant drainage from roots of water; a third is, to expose the roots to the most favourable amount of bottom heat, which cannot be readily accomplished when plants of large size are made to grow in the ground, even of a hothouse; and, finally, it is a convenient process for the nourishment of delicate seedlings. Unless some one of these ends is to be answered, and cannot be effected in a more natural manner, potting is better dispensed with."—(*Lindley.*)

POUDRETTE. Dried night soil mixed with charcoal powder, with gypsum, with lime, with peat, or merely dried in the air. The manufacturers usually reserve the process: that with gypsum and charcoal is best. From twenty to thirty bushels the acre are used with great effect in the drill, or sown over growing crops in spring. It forwards the plant considerably, but seldom lasts for more than one season. See *Night Soil.*

POULTICE. "An external application employed for promoting the suppuration of tumours, or abating painful inflammation. The chief intention of the poultice is to retain the heat on the tumour for a sufficient length of time; consequently, corn meal, linseed meal are the best fitted for poultices. The fatty matter usually added is to give softness to the poultice, which is otherwise apt to harden as the moisture evaporates. Few farmers are aware of the value of these simple applications in abating inflammation, relieving pain, cleansing wounds, and disposing them to heal. The poultice may be rendered more soothing by opium, or increased activity may be given by the addition of common turpentine or chloride of lime, and in cases of foul ulcers powdered charcoal may be added. As an emollient poultice for grease and cracked heels, and especially if accompanied by much unpleasant smell, there is nothing preferable to a poultice of mashed carrots with charcoal. It is always best to enclose poultices in bags."

POULTRY (from the French *pou-*

let). The term includes all the domesticated birds reared for the table: fowls, turkeys, geese, ducks, and Guinea fowls.

"*Fowls.*—'The strong feet of the gallinaceous birds are adapted to the region where they chiefly resort for their food and the purposes of incubation; their toes and nails peculiarly formed for scratching up the grains and seeds which constitute the main part of their subsistence; their short wings and the weakness of their pectoral muscles, which cause the heaviness of their flight, a deficiency which is counterbalanced by the strength of those muscles of the thighs and legs that contribute to their powers of running; their gregarious, and, generally speaking, polygamous habits; the ease with which they are domesticated; their wholesome flesh, together with many striking peculiarities in their anatomy, serve equally to distinguish them.'

"Some foreign varieties have not even the rudiment of a tail, while others are distinguished by it. The gamecock, which is probably a native of India, has an unusual length of spur, his natural weapon of combat. The flesh of this variety is delicately white and of the finest flavour, the plumage brilliant, and the form symmetrical; but from their pugnacious temper, there is great difficulty in rearing even those of the same brood; and for companionship with the general inmates of the fowl-yard they are very exceptionable for the same cause.

"The best breed of *Dorking* fowls is the produce of the Dorking cock and the common dunghill fowl. This cross is larger and plumper, and more hardy than the pure Dorking, without losing delicacy of flavour or whiteness of flesh.

"The characteristics of the pure Dorking are, that it is white-feathered, short-legged, and an excellent layer. The peculiarity of this established variety, which has frequently five claws perfectly articulated (with sometimes a sixth springing laterally from the fifth, but always imperfect), is well known. But though the true Dorking, which is white, is much esteemed, that colour is rare, and prized for the ornament of the poultry-yard: speckled colours are most generally seen.

"The *Poland* breed, which is black-feathered, with white topknots, lays well, and is highly desirable where the production of eggs for the table is the principal object; but they seldom sit.

"The *Chittagong*, or *Malay*, which is a very large Indian variety, is generally long-legged, with yellow body and coarse, yellow flesh. Fanciers used to like them for their fine appearance and their large eggs; but as their long legs incapacitate them from steady sitting, they are not general favourites. One of our practical acquaintances recommends the male produce of the Poland and Chittagong as a good cross with the common dunghill hen, as their progeny will sit.

"Parmentier thus describes the cock: 'He is considered to have every requisite quality when he is of a good middling size; when he carries his head high; has a quick, animated look, a strong and shrill voice, short bill, a fine red comb, shining as if varnished; wattles of a large size, and of the same colour as the comb; the breast broad; the wings strong; the plumage black, or of an obscure red; the thighs very muscular; the legs thick, and furnished with strong spurs; the claws rather bent, and sharply pointed. He ought also to be free in his motions, to crow frequently, and to scratch the ground often in search of worms, not so much for himself as to treat his hens. He ought, withal, to be brisk, spirited, ardent, and ready in caressing the hens; quick in defending them, attentive in soliciting them to eat, in keeping them together, and in assembling them at night.'"

"The *Bantam* is a beautiful little bird, usually white in colour, with short legs, feathered oftentimes to the extremity of its toes. It is often of variegated colours, inclined to red, brown, and white, prettily mixed. Occasionally a variety is met with that are smooth-legged. They are very domestic, often making their nest in the kitchen and cupboards of the dwelling, when permitted. They are excellent layers and good nurses, but require a dry location, on account of their short, feathered legs. The males are wonderful crowers, exceedingly pugnacious, and make three times the fuss about the poultry-yard that anything, but a bantam, should do. They arrive at maturity early, and are well worthy of propagation.

"The *Bucks County* breed has received some celebrity in the neighbourhood of Philadelphia as a valuable variety of fowl, principally on account of its enormous size. I have seen many specimens of this fowl, paid some attention to its habits, and learned from those who have tried them their principal merits. It is a large bird, weighing, at maturity, eight, and even ten pounds, rather thinly feathered, of various colours from gray to black, and frequently speckled black and white. They are coarse in their legs, tall and bony, and have evidently a cross of the Malay in their composition. They are but moderate layers; their eggs very large and good. They are bad sitters, frequently breaking their eggs, on account of their great weight and size, by crushing them; are not hardy, and, on the whole, will not compare with the common dunghill fowl for ordinary uses. They do not breed *equally* in size and appearance, showing them, evidently, to be a cross from other breeds; but from what they are derived, other than the Malay, it is difficult to say. A gentleman of my acquaintance, who is very curious as well as nice in the selection of his fowls, tried them effectually for his poultry-yard, and they disappointed him. He then crossed them with the game breed, and has succeeded finely, the cross being reduced in size, fuller feathered, hardier, and better layers, with an excellent carcass, and finer flesh. As a fancy fowl, or to make up a variety, they are very well, but they can never become of great *utility*, except to cross with the common or the game fowl, to the farmer.

"The *Java* or *Indian* fowl is a large, coarse bird, covered with a coarse, long down or hair, of a dirty white or yellow colour, and running from that into all the shades of brown, even to a smoky black. It appears to differ little from the Malay fowl, save in its crowing, and perhaps laying deeper-coloured eggs. Its general characteristics are the same. In the Northern States it is hardly worth propagation: as a fancy bird, it possesses neither beauty nor utility."

"Those who intend to rear fowls or any kind of poultry on a large scale should have a distinct yard, perfectly sheltered, and with a warm aspect, well fenced, secure from thieves and vermin, and sufficiently inclined to be always dry, and supplied with sand or ashes for the cocks and hens to roll in, an operation necessary to disengage their feathers from vermin: running water should be especially provided; for the want of water, of which all poultry are fond, produces constipation of the bowels and inflammatory diseases; and for geese and ducks bathing is an indispensable luxury. A contiguous field is also necessary for free exercise, as well as for the supply of grubs and grass to the geese. The fowl-house should be dry, well roofed, and fronting the east or south, and, if practicable, at the back of a stove or stables, warmth being conducive to health and laying, though extreme heat has the contrary effect. It should be furnished with two small lattice windows, that can be opened or shut at pleasure, at opposite ends, for ventilation, which is frequently necessary; and the perches should be so arranged that one row of roosting fowls should not be directly above another.

"M. Parmentier has shown by what arrangement a house twenty feet long and twelve feet wide may be made to accommodate 150 hens at roost. The plan is simply this: the first roosting-perch (rounded a little at the upper angles only, for gallinaceous fowls cannot keep a firm hold on perfectly cylindrical supporters) should be placed lengthwise, and rest on tressels in each end wall, six feet from the front wall, and at a convenient height, which must depend on the elevation of the house from the floor, which should be formed of some well consolidated material that can be easily swept. Another perch should be fixed ladder-wise (*en échelon*) above this, but ten inches nearer to the back wall, and so on, until there are four of these perches, like the steps of a ladder when properly inclined, but with a sufficient distance between the wall and the upper one to allow the poultry-maid to stand conveniently upon when she has occasion to examine the nests, which it is her duty to do every day at least once, and in the forenoon. The highest of these she can reach by standing on a stool or step-ladder. By this contrivance the hens, when desirous of reaching the nests, have no occasion to fly, but merely to pass from one stick to another. If the size and form of the house permit, a similar construction may be made on the opposite side, care being taken to leave an open space in the middle of the room, and a sufficiently wide passage for the attendant to pass along the walls. It is not at all required to have as many nests as hens, because they have not all occasion to occupy them at the same time ; and besides, they are so far from having a repugnance to lay in a common receptacle, that the sight of an egg stimulates them to lay. It is, however, true that the most secluded and darkest nests are those which the hens prefer.

"The nests, if built into the wall, are in tiers from the bottom to the top, the lowest being about three feet from the ground, and a foot square. If the laying chambers consist of wooden boxes, they are usually furnished with a ledge, which is very convenient for the hens when rising.

"But the best receptacles for the eggs are those of basket-work, as they are cool in summer, and can easily be removed and washed. They ought to be fastened, not directly to the wall, as is generally the case, but to boards fixed in it by hooks, well clinched, and with a little roof to cover the rows of baskets. They will thus be isolated, to the great satisfaction of the hen, which delights in the absence of all disturbing influences when laying. All the ranges of nests should be placed check-wise, in order that the inmates, when coming out, may not startle those immediately under. Those designed for hatching should be near the ground (where instinct teaches the hen to choose her seat), and so arranged that the hens can easily enter them without disturbing the eggs. The house should be thoroughly fumigated with tobacco and sulphur in spring, to kill the disagreeable lice, the straw, &c., all changed, and the dung carefully removed.

"Wheaten or rye straw is the most approved material for the bedding, being cooler than hay : the hens are sometimes so tortured by lice as to forsake their nests altogether, in an agony of restlessness. A housewife has assurred us that she once lost an entire clutch, from having, as she believes, given a bed of hay seeds to her sitting hen. The chicks were all glued to the shells, and thus destroyed, owing, as she thinks, to the high temperature occasioned by the fermenting seeds.

"For all purposes two cocks in a good run are considerd as sufficient for twelve or fourteen hens, but in France they allow twenty mistresses to each cock, which no doubt is on account of the higher temperature there. In a confined yard, five hens are sufficient for one cock, and a double set will not answer in very limited space. When there are two or more cocks, care should be taken not to have them of equal age or size, for in this case they are always jealous and quarrelsome ; if one is decidedly ascendant, the other will never presume to dispute with him. It will be judicious, also, to avoid the introduction or changing of cocks in the breeding season, for the hens require constant intercourse with them, and several days frequently elapse before they become familiarized with a stranger. The best way is to bring in the new cock in the summer, either as a chick, or late in the year in the moulting season, when he will not take too much notice of the hens. As a general rule, it would be well to have one a yearling, and the other a year older. In the third year, the cock, who then becomes lazy and excessively jealous, should be killed.

"In order to have the earliest chickens, hens should be induced to sit in October, which they may do if they have moulted early. By attention in this particular, chickens can be brought to the market at Christmas; but the object should be, in general, to set the eggs as soon as possible after Christmas, in order to have chickens with the forced asparagus in March.

"In selecting eggs for hatching, care should be taken that they are not, at the utmost, more than a month old, but their condition for hatching will greatly depend upon the temperature of the weather: vitality continues longest when the air is cool.

"It has been asserted that the future sex of the bird is indicated by the shape of the egg, the round producing the female, and the oblong the male. But this is contradicted, and, we believe, with sufficient reason, and it is impossible not only to foretell the sex, but even to ascertain whether the egg be fecundated. This, however, is certain, that if the air-bag (at the obtuse end), which has been mistaken for the germ, and the purpose of which is to oxygenate the blood of the chick, be perforated even in the least conceivable degree, the generating power is lost altogether. Those eggs only which have been fecundated by the male are possessed of the vital principle. The number of eggs for a hen should not exceed sixteen, as she cannot impart the necessary warmth to more. It is by no means uncommon with experienced breeders to place two hens on the same day on their respective eggs, and then on the twenty-first day, when the broods are out, to give the maternal charge of both to one of the hens, removing the other to another set of eggs, which, if she be a steady setter, she will hatch as in the first instance. This, however, must be deemed a cruelty, though some hens would instinctively continue to sit until death. They would, however, become so attenuated by continued sitting, as to lose the power of communicating to the eggs the necessary degree of warmth. The practice of the Surrey breeders is to feed the hen on oats while sitting, as less stimulating than barley, which they give to the laying hens on account of this very quality.

"Some fanciers use artificial mothers, which effect the purpose of imparting the necessary heat to the young chicks after birth, when there is no natural mother nor a trained capon to brood them. These artificial mothers—as used by Mr. Moubray, and described by him—are boxes lined throughout with wool. He recommends that a curtain of flannel should be suspended over the opening of the box for the exclusion of cold air.

"Mr. Young states that 'five broods may at once be cherished under an artificial mother. This mother may be framed of a board ten inches broad and fifteen inches long, resting on two legs in front, two inches in height, and on two props behind, two inches also in height. The board must be perforated with many small gimlet-holes, for the escape of the heated air, and lined with lamb's skin dressed with the wool on, and the woolly side is to come in contact with the chickens. Over three of these mothers a wicker basket is to be placed for the protection of the chickens, four feet long, two feet broad, and fourteen inches high, with a lid open, a wooden sliding bottom to draw out for cleaning, and a long narrow trough along the front, resting on two very low stools, for holding their food. Perches are to be fixed in the basket for the more advanced to roost on. A flannel curtain is to be placed in front, and at both ends of the mothers, for the chickens to run under, from which they soon learn to push outward and inward. These mothers, with the wicker baskets over them, are to be placed against a hot wall, at the back of the kitchen fire, or in any other warm situation where the heat shall not exceed 80 degrees of Fahrenheit.

"'When the chickens are a week old, they are to be carried, with the mother, to a grass-plat, for feeding, and kept warm by a tin tube filled with hot water, which will continue sufficiently warm for about three hours, when the hot water is to be renewed. Towards the evening the mothers are to be again placed against the hot wall.'

"The artificial mother, however, is only a mechanical house for chicks already hatched; but the process of bringing the embryo of organized life in the egg through all the stages of the vital principle, until it becomes matured, by means of heated ovens, has been long and successfully practised in Egypt.

"These ovens, which are constructed with bricks, are about nine feet high, with galleries extending through the whole length, and containing chambers into which a man can creep, through a very contracted orifice, for the purpose of depositing the eggs, which are laid, to the amount of several thousands, on mats or beds of flax over the brick floors. The heat is conveyed through fire-places; and the material of the slow fires, which are most effective, is the dung of cows or camels combined with straw. The fires are kept up for as many days (according to the temperature of the weather) as are sufficient to impart such a degree of heat as will continue to the expiration of the 21 days required for the hatching of chickens, care being taken to confine the warmth by closing up all the orifices communicating with the external air. One hundred millions of chickens are said to be thus annually produced in Egypt.

"M. Réaumur made various experiments in hatching with fermented dung in hot-beds, but unsuccessfully; life was developed, but never matured; the chicks were in some cases even feathered, but long before the full time they lost vitality. He succeeded at length, 'after trials enough to wear out the most enduring patience,' with an oven free from the influence of the vapour exhaled from the dung, which in the previous experiments had been destructive of the embryo. He afterward succeeded, to a great degree, by using a box or shelves over an oven, with due regard to uniformity of temperature. Several of the eggs in this latter case were hatched on the twentieth day, by which the usual course of nature was anticipated by one day. But though artificial hatching has long been practised with success in Egypt, it has not been found worth the expense and trouble in France, from the variableness of temperature there compared with that in the Delta, where, in the autumnal season, when the mammals (hatching-ovens) are used, it is remarkably steady and extremely warm.

"Since the attempt to pursue the Oriental system has failed in France, there is no probability of its succeeding in the climate of Great Britain; but it by no means follows that success may not attend such management as will obviate the obstructions which arise from irregularities of temperature. The object was partially attained some years ago by means of steam, but uniformity of heat was not preserved, and, consequently, that experiment failed. It would appear, however, that the application of the Eccaleobion* machinery, exhibited in London by Mr. Bucknell, the inventor and proprietor, may be successful. Mr. Bucknell asserts that his eccaleobion possesses a perfect and absolute command over temperature from 300 degrees of Fahrenheit to that of cold water; so that any substance submitted to its influence shall uniformly be acted upon over its whole sur-

* From ἐκκαλέω, *I call forth*, and βίος, *life*.

face at any required intermediate degree within the above range, and such heat maintained unaltered, without trouble or difficulty, for any length of time, and that 'by means of this absolute and complete command over the temperature obtained by this machine, the impregnated egg of any bird, not stale, placed within its influence at the proper degree of warmth, is, at the expiration of its natural time, elicited into life, without the possibility of failure, which is sometimes the case with eggs subjected to the caprice of their natural parent.'

"That chickens are thus hatched in considerable numbers is unquestionable, upward of thirty thousand having been already brought into existence by this single eccaleobion machine; nor has any difficulty been found in the subsequent rearing of those chickens, when proper yards and suitable temperature were provided, more than in the natural way; indeed, in some respects less so, as the losses sustained in poultry by the sudden changes of the weather, and the influence of dampness in particular, and accidents from various causes, are very considerable. Supposing Mr. Bucknell's experiment to answer the purpose in every respect, the increase in the production of poultry might be rendered incalculably great by the adoption of his principle on a great scale, wherever the essentials of a dry soil, warmth, and proper buildings can at the same time be supplied.

"'It must have struck even the most superficial observer, that the extraordinary fecundity of gallinaceous fowls is a wise and most benevolent dispensation of nature to provide the more abundantly food for man, as, in those tribes of birds not suited for his table, the female lays no more eggs than she can incubate. With respect, therefore, to domestic poultry, the most nutritious of all human food, this rich provision of a bounteous providence is, for the first time, available to Europe.'

"The eccaleobion machine, capable of containing 2000 eggs, resembles an oblong box, nine feet in length, three feet in breadth, and the same in height. It has no connexion with the walls, against which it is placed on the table on which it stands; its regulating power is within.

"The following striking passage, from Mr. Bucknell's work 'On Artificial Incubation,' above alluded to, will show the importance of this subject in its commercial and domestic bearings.

"Mr. Bucknell observes (page 16), 'We call the Egyptians barbarous; the procuring, however, by art and industry, an abundant supply of that necessary of life, good animal food, is no evidence of barbarism. If the population of the United Kingdom, which, as respects Egypt, is as twenty-four to two, were as well supplied with this artificial production as Egypt, it would require, not 92,000,000, but 1,104,000,000 of poultry annually, for them to be as well fed in this respect as the uncivilized natives of Egypt. But how stands the account in this matter? Full one third of our population subsist almost entirely, or, rather, starve, upon potatoes alone; another third have, in addition to this edible, oaten or inferior wheaten bread, with one or two meals of fat pork, or the refuse of the shambles, per week; while a considerable majority of the remaining third seldom are able to procure an ample daily supply of good butcher's meat, or obtain the luxury of poultry from year to year.

"'On the Continent of Europe the population is still in a worse condition: fish, soups made from herbs, a stuff called bread, made from every variety of grain, black, brown, hard, and sour, such as no Englishman could eat; olives, chestnuts, the pulpy saccharine fruits, roots, stalks, and leaves, and not unfrequently the bark of trees; sawdust, blubber, train-oil, with frogs and snails, make up and constitute a good part of the food of the greater portion of the inhabitants of Europe. There is no other cause for this than the excessive ignorance of its population.'

"The contemplation of the progressive stages through which life is developed and matured in the egg is highly interesting. The contents of the shells, of the species under immediate consideration, taken out and placed on a plate or a saucer on Mr. Bucknell's table, present the following appearances, according to the respective periods:

"On the third day, the embryo organization of the skull, brain, heart, and blood, is perceptible by the aid of a magnifying glass.

"Fourth day. The pulsation of the heart is distinguishable by the naked eye.

"Sixth day. The chief vessels and organs rudimentally formed; the pulsation and circulation of blood apparent.

"Ninth day. Intestines and veins formed, and the deposition of flesh and bony substance commenced; the beak for the first time open.

"Twelfth day. The feathers have protruded, the skull has become cartilaginous, and the first voluntary movement of the chick is made.

"Fifteenth day. Organs, vessels, bones, feathers, closely approaching, in appearance, to the natural state.

"Eighteenth day. Vital mechanism nearly developed, and the first sign of life heard from the piping chick.

"Twenty-first day. The chick breaks the shell, and in two or three hours is quite active and lively.

"The exit of the chick from the shell is assuredly one of the most interesting processes of animated nature ever investigated by naturalists. It was supposed that the mother bird broke the shell; but M. Réaumur has long since detailed the processes, and we ourselves have witnessed the evolution of the chick in the eccaleobion, by its own unassisted efforts, The French naturalist to whom we have just now referred thus explains some interesting facts: 'I have seen chicks continue at work for two days together. Some, again, work incessantly; others take rest at intervals, according to their physical strength. I have observed some, in consequence of their impatience to see the light, begin to break the shell a great deal too soon; for they ought, before they make their exit, to have within them provision enough to serve for twenty-four hours without taking food, and for this purpose the unconsumed portion of the yolk enters through the navel. The chick, indeed, which comes out of the shell before taking up all the yolk, is certain to droop and die a few days after it is hatched. The help which I have occasionally tried to give to several of them towards their deliverance has afforded me an opportunity of observing those which had begun to break their shells before this was accomplished; and I have opened many eggs much fractured, in each of which the chick had as yet much of the yolk not absorbed. Besides, some chicks have greater obstacles to overcome than others, since all shells are not of an equal thickness nor of an equal consistence; and I think it probable that the same inequality takes place in the lining membrane. The shells of the eggs of birds of various species are of a thickness proportional to the strength of the chick that is obliged to break through them.'*

"If the chick should be glued to the shell, as sometimes occurs, and is indicated by the faintness of its chip and the non-enlargement of the fracture for some hours, it must be assisted (but not until the necessity is fully ascertained) in its liberation 'with a key, or some such instrument, and by cutting the membrane with the points of a pair of scissors. The operation, though painful to the chick, does not prove mortal; for it is no sooner freed than it exhibits as much vigour as any other chick of its age.'† But unless the chick, after a full day's effort, is found unable to chip the shell, from weakness or adhesion to its envelope, it is better not to assist it in its extrication; for in ninety-nine cases out of a hundred aid proves ineffectual, through the injury inflicted upon the delicate or-

* "Domestic Habits of Birds," *Library of Entertaining Knowledge.* † Ibid.

ganization of the bird; or, more probably, the previous weakness or imperfection of the chick, which occasioned the necessity for assistance, also occasions its death at the moment of its birth, and would take place even if its disengagement were effected without any injury.

"There is a caution to be observed in all cases regarding the eggs when the chicks are on the verge of maturity: they should not be stirred when within two days of the evolvement of the chicks. If any circumstances render it absolutely necessary to do so, care should be taken to place them with the broad end inclining upward, as the beak of the chick is then in its proper position; and if this be reversed, the chick becomes unable to chip the shell, and must therefore die.

"Chickens should be fed the day after their birth with crumbs of bread soaked in milk, or with the yolk of an egg boiled hard; and they will quickly learn to eat curds, grits, and barley-meal and milk. If not designed for immediate use, they should soon get raw corn, and occasionally alteratives of green food, such as bruised leeks, nettles, lettuces, &c. For the first week they should be confined to the house altogether; after that time they may be let out for a short time in the sun, and gradually habituated to the weather. To render the hen, which has already discharged her duty, still more productive to her owner, she is frequently confined to a coop, called, in Surrey, a *rip*, for some weeks after the chicks have seen the light. Her offspring during this time pass freely through the prison bars, returning at her call, or on occasions of alarm, to the maternal wings, and then hopping out again, to the inexpressible misery of their imprisoned mother, who is kept in this state of confinement until she becomes indifferent to the chickens and disposed to lay again.

"The courage of the hen in defence of her offspring has been a common theme of admiration; the force of her maternal solicitude effects the most surprising change in her disposition and temper. Before she attained her matronly character, she was greedy, and always searching for food, fond of gadding about, and timid in the extreme. Now she becomes generous, self-denying, and intrepid; she assumes the fiery temper of the cock, and becomes a virago in defence of her helpless brood. An anecdote is told by White, in his 'Natural History of Selborne,' of the punishment inflicted by some hens upon a hawk which had, at different times, killed their chickens. By some means this hawk was caught, and the owner gave him up to the tender mercies of the bereaved mothers. In his own words, 'Resentment suggested the laws of retaliation. He clipped the hawk's wings, cut off his talons, and, fixing a cork on his bill, threw him down among the brood hens. Imagination cannot paint the scene that ensued; the expressions of fear, rage, and revenge inspired were new, or, at least, such as had been unnoticed before. The exasperated matrons upbraided, they execrated, they insulted, they triumphed. In a word, they never desisted from buffeting their adversary till they had torn him in a hundred pieces.'

"The same writer calls attention to the language of the fowl, from a pleased twittering to a scream. A laying pullet utters a complacent, soft note; but when she has been delivered of an egg, her cackle of delight and importance is loud enough to excite the sympathetic voices of all her companions; when her chickens are hatched, she has a different language, which is intelligible to her little ones. The crested cock has various notes; his tone and language, for such it is in effect, as he calls his favourites to partake of the food which he gallantly scrapes for them, is of a very peculiar kind, and very different from his ordinary voice, that is so familiar to us.

"Poultry are the better for high feeding from the very shell, and, on this account, the heaviest corn is often far cheaper for them in the end than tailings, as regards the flesh, or the size and substantial goodness of the eggs. Chickens may be put up for feeding as soon as the hen has ceased to regard them, and before they lose their first good condition. When chickens are wanted for domestic purposes, they are often left at liberty in the farm-yard; and if they have plenty of good food, they will be in the most healthful state for the table, and rich and juicy in flavour. Mr. Moubray ascertained that pullets hatched in March, if constantly high fed, laid eggs abundantly in the autumn; and if killed in the February or March following, were so excessively fat from the run of the yard as to open more like Michaelmas geese than chickens. Experienced poulterers will fatten fowls in two or three weeks with the aid of grease, which gives a luscious, but, in our judgment, a very disagreeable flavour to the flesh, which, though not actually diseased, is very inferior to that of the fowl fed at large in the common way at the barn-door.

"The practice of cramming poultry by the hand is quite common. A machine for this purpose is used in France, by which one man can cram fifty birds in half an hour. It is somewhat on the principle of a forcing-pump. The throats of the birds are held open by the operator until they are gorged through a pipe, which conveys the food from a reservoir below, placed on a stool. In fifteen days fowls are said to attain the highest state of fatness and flavour by this feeding. In addition to the ordinary paste of barley-meal, or meal made into little balls with milk, the dried seeds and leaves of nettles have been recommended by the continental poulterers, some of whom give a little henbane seed to induce sleep, while others put out the eyes of the prisoners, as the most effectual way of keeping them in a state of darkness, which is considered essential to their becoming rapidly fat; and, under the pretext of relieving them from the irritation of vermin, they pluck the feathers from their heads, bellies, and wings. While fowls are thus preparing for the knife, though their bodies are closely confined, their hinder parts are free for evacuation and cleanliness, and their heads are at liberty to take in fresh supplies of nutriment.

"The practice of making capons (emasculating the males) is practised a little in some of the English counties, and very much in France, where the females are also rendered incapable of breeding, and termed in their unsexed condition *poulardes*, in order to give them the tendency to fatten. An incision is made near the parts, and through this the finger is introduced to take hold of and bring away the genitals, but so carefully as not to injure the intestines: the wound is then stitched up, and rubbed with oil or grease; and the comb (which appears to be an unnecessary and gratuitous pain and insult to the sufferer) is often cut off. The females are treated much in the same way, when they do not promise well for laying, or when they have ceased to be fertile; they are deprived of the ovarium. The subsequent treatment is similar to that in the former case. Care is taken to give them good food for three or four days, and during that time to keep them in a place of moderate temperature, to avoid the danger of gangrene, which, considering the time of the year—midsummer, when the operation is usually performed—is a very probable consequence. Pullets of the largest breed are selected for the purpose, as they yield the greatest weight to the poulterer; and, if employed in hatching, cover the greatest number of eggs.

"Cuvier states that the capon may be taught to hatch eggs, and to act the part of a good nurse, with a little bell round his neck to supply the want of a good voice. He asserts that the natural courage and energy of this bird are not abated by the alteration of his condition, in which his audacity enables him to impose on the cocks and hens, so that they allow him to strut about with his former gait of consequential importance, and to fulfil his duties without interference or molestation. This seems incredible, as a bold and haughty spirit under such circumstances is unnatural in the extreme. The pallidness of his head and the diminutiveness of his comb and gills indicate the contrary disposition, and he is so despised by the other fowls that they will hardly condescend to roost with him.

"Mr. Young, in his 'Report of the County of Sussex,' says that much art and attention are requisite to make capons, and that the Sussex breed are too long in the body for success in the operation, by which many are lost. A perfectly fat capon will weigh from seven to ten pounds.

"As soon as fowls are rendered sufficiently fat, they should be killed, or they will loose flesh and become unhealthy. The most humane and expeditious mode of putting them to death is by a smart blow with a blunt-edged stick, such as a child's bat, at the back of the neck. Higglers break the vertebræ of the neck by a sudden twist, and never bleed fowls, as this mode of despatching them dries up the juices of the flesh. They bleed turkeys and geese, however, after a stunning blow on the neck, not by cutting the throat, but by an incision in the upper part of the mouth.

"Store fowls will feed well upon the tailings of corn, potatoes, and insects, and require little attention except when laying, during which time the food for the hens should be abundant, and their roosting places dry and warm.

"The diseases of all poultry principally arise from cold and moisture. *Rheumatism* decidedly arises from this cause. During or after moulting in a wet season, fowls frequently become diseased, as is evident from their drooping appearance, swelled and watery eyes, and the dropsical affections of the legs. Severe laying also sometimes causes emaciation and illness, which give way to a more healthy condition after the moulting season, if they have good food and dry weather.

'Chickens are very subject, in wet or variable weather, to a disease called the chip, which appears in about a fortnight after their birth, when they are changing their feathers. Warmth and sunshine are the only restoratives within our knowledge.

"The *roup* is properly a gathering upon the rump, which is cured or relieved by opening, squeezing, and bathing with warm water. Mr. Mowbray, however, who is a good practical authority, states that the roup is a general term for all diseases, though it is chiefly applied to catarrh, which is indicated by watery eyes and running at the nostrils. This last disease resembles glanders in horses, and is infectious, and generally fatal. As all these diseases originate in moisture, dryness and warmth are the best counteracting influences. The nostrils should be washed with soap and water, and the eyes with milk and water. Mr. Mowbray recommends a pepper-corn in dough at first, to impart warmth, and afterward calomel three times a week, as a finish to the cure.

"We have had the trachea of a chicken dying of the *gapes* (which is the incipient stage of roup) cut and opened, and have taken out narrow worms, about half an inch in length, which lay imbedded in a serous fluid. A medical friend has frequently cured fowls of the same disease by putting the upper part of a feather, stripped for the purpose, down the trachea, turning it round, and thus bringing up the worm, which he thinks is the sole cause of the disease. It may, however, be the effect of the malady, as is the opinion of many.

"The *pip*, which the same individual considers analogous to the thrush in the human kind, he cures, not by scraping roughly, but by an application of powdered borax dissolved in tincture of myrrh and water, and rubbed on the tongue with a camel's-hair brush two or three times a day. This, at the same time, assists the bowels. The *flux* is not uncommon. Solid corn is the most certain remedy for this disease. Taken at the commencement, it is rarely serious, but if once established in the constitution, it becomes incurable, and, according to some, contagious. For *constipation*, bran, or pollard, with milk, beet leaves, and lettuces, afford a certain cure.

"Much of the foregoing matter applies to the rearing and management of all poultry. The succeeding observations will be brief.

"*Turkeys.*—The greatest weight to which our domesticated poultry can be made to attain is thirty pounds, and a turkey of even half this weight is a 'dainty dish.'

"The varied plumage of the bird in the domesticated state is well known to every one; and in no species is that sure mark of subjection to man more strongly seen. The bronze, or copper-coloured, is not considered hardy, nor often reared, and the varieties may be stated to be only twofold, the dark-coloured and the light.

The dark-coloured birds are most prized for size and hardihood.

"Turkeys, though extremely delicate in their infancy, become very hardy, and, if permitted, will roost on the highest trees, in the cold dry nights of winter, without suffering injury. The hen, which lays many eggs early in spring, sits thirty days, and covers from twelve to fifteen eggs. It is unnecessary for the turkey-cock, as is the case with gallinaceous fowl, to be in constant intercourse with the hen during her period of laying. Two visits from him in that season are sufficient to impregnate all the eggs. She is a very steady sitter, and must be removed to her food and supplied with water, for she would never leave her nest. She wants the alertness, and courage, and sagacity of the common hen, and might be called a fool with much more propriety than the goose, which is an intelligent bird. The turkey hen is incapable of teaching her young ones how to pick up their food, on which account a poultry maid should always attend them until they are reared.

"On account of the constitutional delicacy of this bird, the hatching should not be commenced too early in the spring, and when the chicks are hatched they should be guarded from the extremes of heat and cold for some weeks. Rain is almost always fatal to them in their early stage. Curd, boiled eggs, and barley or oatmeal, kneaded with milk (or water, in case milk should produce looseness), potatoes, nettles, parsley, Swedish turnips, with chopped beet leaves, after a little time, are their proper food. As they retain so much of their original wild nature as to stray a considerable distance, if permitted, the hen should be tied or cooped for at least six weeks, when the chicks will be hardy enough to follow her about, under the vigilant eye, however, of the poultry maid, who should beware of their being caught by a shower.

"They are soon familiarized to the society of fowls in the poultry or farm yard. Without the advantage of the latter, it is an unprofitable speculation to rear any description of poultry on a large scale; but where a farmer's yard presents facilities, the economy of having all those kinds to which the soil and climate are suitable is considerable. The only caution with regard to turkeys, where gallinaceous birds are numerous, is to have separate houses for them at night. These should be very lofty and well ventilated. They may be altogether open to the air in front, the doors being of trellis-work. Fowls (which are equally unsocial with the capons of their own kind) have a strong disinclination to roost with them.

"When well grown, turkeys supply themselves in their ramblings so far as to require food only when leaving their house in the morning and returning at night. The chances of rearing a second brood are not so great as to render it expedient to make the trial.

"After six months, turkeys may be crammed like fowls, but they require a much longer period to render them fully fat. Those great birds which are sent to the market about Christmas, frequently weighing from twenty to twenty-five pounds, are usually cocks from the preceding year.

"*Guinea Fowl.*—This bird, which is not much larger than the common barn-door fowl, is of beautiful form and plumage, and, though not a source of profit to those who rear poultry for immediate sale, is usually kept where there is proper accommodation, as much on account of the excellence and abundance of the eggs (which, though small, are well-flavoured) as for the sake of the flesh, which is prized. The number of hens allowed to the male is about the same as among the gallinaceous family. The cock, little distinguished in appearance from the female, is an attentive and affectionate mate, and even obtrusively so to his favourites, whom he will attend to the nest, and remain with until they have laid their eggs.

"Retaining some of their original wildness, Guinea fowl dislike the confinement of a house. For the purpose of laying, they prefer shrubberies, clover meadows, or corn-fields, in which they will deposite their eggs, unless closely watched. The Guinea hen is fruitful during the entire summer, but not earlier than May. On this account, and the difficulty of rearing a late brood, it is more beneficial to keep her entirely for laying, and to put the earlier eggs under a common hen, or capon, which will cover from twenty to twenty-five, than to encourage the incubation of the natural parent, which is, moreover, indisposed to it, especially if under cover. If left to her instinct, this bird would, at a late season, in the open air, sit for the natural period, which is twenty-eight or twenty-nine days.

"The cock, having the same dislike to incubation which characterizes the male of pea fowl, will destroy the eggs if he can discover them. Though the shell is remarkably hard, the chicks break through it at the proper moment, and are soon after as vigorous and ready to eat as the young of any other tribe of poultry.

"The loud cry of these birds is not agreeable, but, like the scream of the pea fowl, it announces with certainty an approaching change of weather. The hen utters a cry when she desires to roost, to call in her companions, to summon assistance, or to give notice of any of those alarms which her sensibilities cause her to express with such energy of voice, and in all which cases she is sure of receiving a ready sympathy.

"The same food which is suited to the young of gallinaceous fowls and turkeys is good for the chicks of this kind; but as they are not often destined to the coops for fattening, a good deal of garden or field green food may be combined with their grits, &c., after the first month. They have a great relish for insects of every kind, and thrive upon them as well as upon hemp seed. When designed for the table, they ought to be killed at an early age, at which time the flesh is more juicy than that of other poultry of the same age, and very like that of the pheasant, though when old it becomes exceedingly tough.

"*Ducks.*—The white duck, being the largest of the common domesticated kinds, is perhaps the best for the poulterer, though it is not deemed so delicate in flavour as the dark-coloured, such as that bred from intermixture with the Rhone duck, which is also large. The Muscovy variety is said to be a good breeder. One drake is sufficient for five females. It is generally believed that the duck lays no more eggs than she can cover (from twelve to fifteen), but Mr. Moubray states that, if well fed, some ducks will lay a great number, and he gives an instance of one laying an egg every day for eighty-five days.

"For a fortnight after their birth, ducklings should be kept from rushing into the water, to which their instinct soon leads them; and with this view the mother is frequently confined (where there is any pond within her reach) to the rip, already described, which should be placed on a field of short grass with a flat dish of water near it. The ducklings waddle about in search of insects, and at the maternal call return to the coop. This restraint upon the liberty of the poor mother should be avoided if circumstances permit, for to protract her close confinement after more than four weeks' sitting is a cruel restraint. It is very common to place duck eggs under a hen, on account of her excellent qualities as a nurse.

"Any kind of meal is good for ducklings at first, and this may soon be mixed with potatoes. The refuse of the kitchen will not only support, but fatten them; but to have them quickly and highly fattened, they should have oatmeal made into paste. They will also devour any animal offal, and have no fastidiousness whatever. If allowed to follow a plough, or attend on the gardener when his spade is at work, their greediness and activity in picking up worms are extreme; and for gobbling up snails and slugs, and other such delicacies in the field or garden, they are most useful, while they are at the same time putting themselves into high condition. Having no fastidiousness of appetite, they never require cramming; indeed, they act as if they considered it their duty to get fat as quickly as possible, and therefore require no artificial aid.

"In a poultry-yard the ducks and geese are frequently lodged on the lower floor of the fowl-houses, but it is better, if the locality will permit, to give them distinct chambers, particularly where a good pond (free from eels) is available; on the margin of this their huts may be placed, with very trifling labour, and an invisible paling all round the water, constructed at bottom on the principle of the cage-trap, so as to prevent the ingress of rats or weasels, while it affords them a ready outlet, renders this department of the poultry establishment complete, though far too expensive for common adoption.

"*Geese.*—The proportion of females to the males is the same as in the duck tribe, and the period of incubation and the number of eggs that may be set correspond exactly. The goose lays in a mild spring very early, and on this account (but only with high corn-feeding in the previous winter, and stimulating food during the entire breeding season) two broods may be had in the same year. Unlike the peacock and the Guinea cock, the gander is not only indisposed to do any mischief to the nests, but is very attentive to the hatching birds, whom he vigilantly protects as he sits patiently by; nor is his protection, as he accompanies the goslings in due course, less creditable to his paternal character. The goose is a very steady sitter, but usually rises often enough to drink and take sustenance, without its being necessary to remove her from her nest for the purpose.

"The early treatment of the goslings is similar to that of ducklings. The mother should be penned up for some days upon dry grass, but neither too early nor very late in the day: beet leaves, or other green food, may be mixed even with the early diet, if immediate fattening be not the object.

"Green geese are brought very early to market; they can be made quite fat with oatmeal and pease, and skimmed milk or buttermilk, when from four to six months old: many prefer oats alone.

"The management of them is thus detailed in a communication to Mr. Moubray:

"'Cleanliness, punctuality, and regularity prevail; the business is conducted, as it were, by machinery, rivalling the vibrations of the pendulum in uniformity of movement. The grand object of preparing, not geese only, but poultry in general, for market, in as short a time as possible, is effected solely by paying unremitting attention to their wants; in keeping them thoroughly clean; in supplying them with proper food (dry, soft, and green), water, exercise ground, &c.

On arriving at the feeders, they are classed according to condition, &c.: they soon become reconciled to their new abode and to each other. They are fed three times a day, and it is truly astonishing how soon they acquire the knowledge of the precise time; marching from the exercise ground to the pens like soldiers in close column. Goslings, or young geese, come to hand generally about the month of April, after which a regular and constant supply arrives weekly throughout the season. At first they are fed on soft meat, consisting of prime barley or oat meal, afterward on dry corn. An idea prevails with many that any sort of corn will do for poultry: this is a grand mistake. Those who feed largely know better, and invariably make it a rule to buy the best. The Messrs. Boyce, whose pens are capable of holding the extraordinary number of 1000 geese, independent of ducks, turkeys, &c., consume 80 bushels of oats daily, exclusive of other food.'

"But though green geese bring an enormous price in the spring, if thoroughly fat, farmers generally find it more profitable to feed goslings on the stubbles, where they supply themselves with the best food without cost, and become sufficiently fat at Michaelmas, when ancient custom renders them a favourite dish.

"Though young geese are subject to a disease called the cramp, the greater number of those which die in summer are destroyed by starvation, and the change from corn, and other nutritive food, to the miserable herbage which the fields and commons yield; and this constitutes their chief diet until the harvest season. Cold and wet weather are often fatal to them in the earlier months, if they be neglected. Much mortality also prevails among grown geese, wherever the horrible system of plucking them alive is practised. It is generally urged in excuse for this barbarity that feathers are most elastic and valuable before the period of moulting, and that geese have been thus treated ever since feather beds came into fashion. The offence carries some punishment with it, for it renders the flesh very tough, and in many respects deteriorates the value of a bird, if it does not destroy it altogether; but the immediate gain from the feathers counterbalances this and every humane consideration.

"The cramming system is practised in France, when the object is to render the liver unnaturally enlarged by disease, with circumstances of great cruelty. We do not intend to give any information upon practices which we cannot recommend, and which we strongly condemn.

"*Eggs.*—The most certain way of preserving eggs fresh is by greasing them with some unctuous matter, or immersing them in milk of lime. In packing, they should be laid on end; for otherwise the yolks, preserving their centre of gravity, fall to the lowest side, and, by adhesion to it, become tainted sooner than if they were suspended in the centre. Briny salt, or sawdust, are good packing materials.

"The only management, besides warmth and high feeding, by which a perpetual succession of eggs can be obtained in winter, is by having pullets and hens of different ages, which, moulting at different periods, do not all cease laying at the same time."

POULTRY DUNG. The urine of birds is solid, and voided along with the matters rejected from the bowels; their dung is, therefore, nearly approaching to urate or the dried urine of animals, and is richer the less vegetable food they take; hence the excrement of sea gulls forms guano, the best manure known. The composition of poultry dung varies with their food, the husks and green, indigestible parts of vegetables being impurities which diminish the value of the white solid uric acid. The composition of the urine or white part is the same for all birds, and consists chiefly of

Uric acid	88·71	Coindet.
Ammonia	8·55	
Bone earth	2·75	
	100·00	

The uric acid by decay becomes converted into bicarbonate of ammonia, so that the manure is nearly approaching to commercial carbonate of ammonia, with a little bone earth. Four or five bushels composted with moist charcoal, gypsum, and peat, and allowed to rot partially, forms a very stimulating application to young plants and seeds, being as good as about one half the quantity of guano. Johnstone makes the following remarks on the comparative value of the different kinds of dung, but it is to be remembered that fowls fed on insects or animal matters will make manure as rich as guano.

"Pigeons' dung is much prized as a manure, wherever it can be obtained in any considerable quantity. In Belgium it is esteemed as a top-dressing for the young flax, and the yearly produce of 100 pigeons is sold for about 20*s*. Its immediate effect depends upon the quantity of soluble matter it contains, and this varies much, according to its age and to the circumstances under which it has been preserved. Thus, Davy and Sprengel obtained respectively of

	Recent. (Davy.)	Six months old. (Sprengel.)	After fermentation. (Davy.)
Soluble matter in pigeons' dung . . .	23 per cent.	16 per cent.	8 per cent.

"The soluble matter consists of uric acid in small quantity, of urate, sulphate, and especially of carbonate of ammonia, common salt, and sulphate of potash; the insoluble chiefly of phosphate of lime, with a little phosphate of magnesia, and a variable admixture of sand and other earthy matters. When exposed to moisture, the pigeons' dung, especially if recent, undergoes fermentation, loses a portion of its ammoniacal salts, and thus becomes less valuable. When it is intended to be kept, it should be mixed with a dry vegetable soil, or made into a compost with earth and sawdust, with a portion of pulverized or charred peat, or with such a disinfecting charcoal as that which is employed in the manufacture of animalized carbon.

"Fowl dung often accumulates, decomposes, and runs to waste in poultry-yards, when, with a little care, it might be collected in considerable quantities

"Goose dung is less rich than that of hens or pigeons, because this bird feeds less upon grain, and derives a considerable portion of its nourishment from the grass which it crops when allowed to go at liberty over the fields. Its known injurious effects upon the grass on which it falls arise from its being in too concentrated a state. In moist weather, or where rain soon succeeds, it does no injury, and even when in dry weather it kills the blades on which it drops, it brings up the succeeding shoots with increased luxuriance."

POUND, LB. The avoirdupois contains 16 oz. and 7000 troy grs. The troy pound 12 oz. and 5760 grs. Also, an enclosure for cattle. In England a penal enclosure for trespassing cattle.

POUPART'S LIGAMENT. A tendinous expansion, running from the top, or *crista*, of the ilium to the os pubis, under which hernias protrude.

POVERTY GRASS. *Aristida dichotoma*. A grass growing on steril places.

POWER. In mechanics, denoting a force which, being applied to a machine, tends to produce motion. A *mechanical power* denotes one of the six simple machines, viz., the *lever*, the *inclined plane*, the *screw*, the *wheel* and *axle*, the *wedge*, and the *pulley*.

POZZUOLANA. Volcanic ashes, used in making hydraulic cements.

PRÆCORDIA. The fore part of the chest.

PRÆMORSE, BITTEN. Stumpy roots which appear to have been bitten.

PRAIRIE. This name is given to the immense tracts of grass land occurring throughout the West. They are usually gently rolling or undulating lands, the grass of which is thickly matted, and from a few inches to three or four feet high, being most luxuriant in wet, swampy places.

The prairie is often adorned with beautiful flowers in spring, and, indeed, throughout the year. The grass is of various kinds, some, as that called buffalo grass, being of great value; the whole is, however, nutritious, and sustains oxen, horses, and sheep remarkably well: there are numerous species. The great defect of the prairie is want of timber; in some places this is provided on the islets of the rivers, or on bluffs, but it is often altogether absent for great distances. There is a description of partially timbered land, called *barrens*, in which the trees stand apart, with a tender grass growing between them.

The method of breaking up the prairie, and other interesting topics to the emigrant, are contained in the following remarks by Mr. Robinson, of Indiana:

"*Breaking up the Prairie.*—Fancy upon a level, smooth piece of ground, free from sticks, stumps, and stones, a team of four, five, or even six yoke of oxen, hitched to a pair of cart wheels, and to them hitched a plough with a beam fourteen feet long, and the share, &c., of which weigh from sixty to one hundred and twenty-five pounds, of wrought iron and steel, and which cuts a furrow from sixteen to twenty-four inches wide, and you will figure the appearance of a 'breaking team' in operation.

"I do believe, though, that a smaller plough and less team would be better for the land, though it is said it would be more expensive ploughing. It is true that the sod is more tough than can be believed by those who have never ploughed it. It requires the plough to be kept very sharp, and for this purpose the ploughman is always provided with a large file, with which he keeps a keen edge as possible upon the share and coulter.

"Such a team ploughs from one to two acres a day, usually about four inches deep, which is not near down to the bottom of the roots, so that the sod turned up affords but a scanty covering for grain that is sowed upon it at first, yet very fine crops of wheat are raised in this way. It is also a common practice to break up in the spring and drop corn in every second or third furrow, and from which twenty or thirty bushels to the acre are often gathered, nothing having ever been done to it after planting. It takes two or three years for these sods to become thoroughly decomposed, and then the soil is of a light, loose, black, vegetable mould, very easily stirred by the plough, but of a nature that it adheres to the plough in a troublesome manner. In fact, no plough has ever been found to keep itself clear; and the ploughman is generally obliged to carry with him a small wooden paddle, with which to clear off the adhering mass of dirt upon the mould-board. With this exception, the prairie soil is generally one of the easiest in the world to till, and of course remarkably fertile.

"By far the greatest portion is based upon a subsoil of clay, though in many places the subsoil is sand or gravel, and there are large tracts of which the surface is of this material. The streams are often broad and nearly covered with vegetable growth, in some instances to that degree that sheets of water, many rods wide, actually burn over during the autumnal fires.

"Notwithstanding the many 'interesting accounts of burning prairies,' the fire upon a dry prairie, in a calm time, does not blaze as high as it would in an old stubble field; but in the marshes, or wet prairies, it sometimes rages with grandeur.

"*Enclosing.*—The settlements already made are upon the smaller prairies, the centre of which are not more than four or five miles from timber, or along the border of 'the Grand Prairie,' taking care not to extend out beyond the reach of convenient woodland. But there are many places where the groves are barely sufficient to furnish the land most contiguous, and vast tracts of prairie are to be found ten or fifteen miles from timber. That these tracts will forever remain uncultivated, cannot for a moment be thought of. That timber can be planted and raised in abundance is certain. It is equally certain that they can be fenced with ditches, and, perhaps, with hedges, though the experiments that have as yet been made in the United States to enclose land with hedges have generally proved failures.

"The most feasible plan, it seems to me, would be to enclose large tracts by ditching, and cultivate the land without division fences, even between many occupants. Such is the mode in many parts of Europe. Or this kind of land could be profitably improved by grazing herds of cattle and sheep, under the care of shepherds. Houses of a most comfortable kind can be built of clay without burning into brick, and the expense of hauling lumber for roofs and inside work would be trifling. The only difficulty would be fuel. In many parts of the West coal exists in abundance, and where that is not to be had, the expense of hauling wood over a smooth and nearly level country would not be a serious obstacle. It is also thought that peat will be found abundant.

"At present, however, there is an abundance of unoccupied land so convenient to timber as to be easily fenced in the common way, with Virginia or worm fence ; and the oak timber of this region is very durable."

PRASE. Green quartz.

PRECIPITATE. A solid matter thrown down in a clear fluid by chemical action.

PREDIAL. Belonging to a farm

PREDISPOSING AFFINITY. Chemical affinity arising in the presence of three bodies, whereby a union is accomplished between two, which, without coming in contact with a third, would not readily unite.

PREGNANCY. The state of being with young, carrying young. The signs and determination of pregnancy are often important. The following, from Mr. Youatt, is of great service in coming to a conclusion on this point.

"Among healthy animals, the impregnation of the female rarely fails to be the result of an intercourse between the sexes. The assurance, however, of this having taken place is occasionally an affair of considerable interest, and of no little difficulty, and the value and the destiny of the female may very much depend on the decision of the question. A certain time having elapsed, the thing will speak for itself; but are there any symptoms or circumstances that will warrant the veterinary surgeon or the agriculturist in giving a decided opinion on the case in an early period of supposed pregnancy?

"It occasionally happens that the fifth or the sixth month arrives, and, even to the practiced eye, there are few or no indications of conception having taken place. There are, also, but somewhat unfrequently, diseases which very closely simulate this natural process. Can the veterinary surgeon or the breeder decide? The answer is in the affirmative, and plainly and unequivocally. This is one of the boons which the veterinary art can now confer on the agriculturist. The altered character of the female is regarded, and very properly, as a circumstance of no little weight. She is comparatively calm and quiet ; her appetite returns, and she regains her former condition and her former habits. Five or six weeks pass, and there is no outbreak of any kind. The owner concludes, and he is not often wrong, that she is impregnated. He, however, has had little to do with mares or with cows who has not witnessed the return of the most furious œstrum, after a much longer period of time has elapsed. I have known more than three months pass in this delusive quietude, and then a salaciousness worse than at first has indicated that no actual impregnation had taken place. On the other hand, the œstrum, but not with all its former fury, has returned two, and three, and four months after the connexion, and yet, as the result finally shows, impregnation had taken place at their first intercourse.

"Many circumstances may cause the owner to be anxious to know the truth of the matter. He may wish to sell her, or he may be unusually desirous to breed from her. Let the animal be examined per vaginam. Let the hand be slowly and cautiously passed up the vagina until it reaches the os uteri. Let there be no attempt to penetrate farther. No information can be gained from introducing the fingers into the uterus. It is simply wished to ascertain the character of the os uteri. In its natural and unimpregnated state it will be closed; but it will not be tightly or spasmodically so, and the contraction of the mouth of the womb will form a kind of cup, with the base towards that viscus. If she is impregnated, the entrance to the uterus will be more firmly closed, and the protrusion will be towards the vagina. This is the only exploration per vaginam which I would allow; it is easily made, and it will be satisfactory. If an exploration of this kind is attempted when half or more than half of the period of pregnancy has passed, it is not at all unlikely that so much irritation of the parts will ensue as to cause the expulsion of the fœtus.

"I will suppose that two months have passed since the supposed impregnation. The fœtus is still remaining in the pelvic cavity. The heart has begun to beat, and the blood to circulate through its little veins. It will be situated immediately below the rectum. I introduce my hand into that intestine. I have no occasion to pass it very far up. I feel the little substance; for it then is small in proportion to its after growth. I feel it under my hand. I am certain that I am pressing upon the uterus and its contents. I cannot, perhaps, detect the pulsation of the embryo; but if I had delayed my examination until the fœtus was three months old, I should have assurance that it was there by its now increased bulk, while the pulsation of its heart would tell me that it was living.

"For two months from this period in the cow, and for three in the mare, I should have no other indication of the presence of the fœtus, nor of its life and growth, except from the gradual enlargement of the abdomen of the mother; and by that time the little one would have increased in size and strength, and would have begun to take occasional exercise in its first domicil, and then would become the more evident, but not more satisfactory proof of the life of the fœtus; its motion strong enough to be seen through the integument.

"I might, perhaps, wish to give this assurance of the life of the fœtus to some curious spectator, or to some intended purchaser. I would not gallop the mare in order to effect this; I would not so far disturb her or the young animal that she bore within her: much less would I give her cold water to drink, and which she usually would drink until she annoyed the fœtus, and the unborn animal told us how much we annoyed him by endeavouring to shift his quarters and get away from the action of the cold. I would not run the hazard of giving her the colic, and perhaps destroying him or her by this unscientific and somewhat cruel method of exploration; but I probably should give a tap or two on the outer wall of his dwelling, just sufficient to rouse him from his slumbers, and induce him to express his anger at the annoyance by a tolerably distinct plunge or kick.

"Most certainly, if it was a cow that I was exhibiting, I would not give, nor would I suffer any one else to give, those terrible punches in the right flank, which, I have no doubt, are the cause of much unsuspected injury, and, occasionally at least, connected with, or the origin of, a difficult or a fatal parturition.

"I may here observe that the fœtus of the mare, from the beginning, occupies nearly the centre of the belly. In the early stage, Mr. Mogford generally found it 'lying across the pelvic cavity, the spine being immediately under; the head on the left side, and the tail on the right side.' In the latter portion of its fœtal state its motions are pretty equally distributed on either side, and the beating of the fœtal heart is most plainly heard at the very base of the abdomen. The fœtus of the cow is huddled up on the right side of the belly. There its motions are most seen, and the beatings of its heart best heard. The enormous paunch, lying principally on the left side, presses every other viscus, and the uterus among the rest, into the right flank. This also explains a circumstance familiar to every breeder. If the cow should happen to carry twins, they are crowded together in the left flank, and one seems absolutely to lie upon the other. Whenever the farmer notices the kicking of the fœtus high up in the flank, he at once calculates on twins.

"To return from this digression. If half the period, or more, of uterogestation had passed, and I could get the little stranger to move by my gentle tapping, and it was a cow with which we had to do, and a quiet one, I would have her carefully held by the cowherd, while I stooped and applied my ear flat upon the flank, and then, slowly, and with gentle pressure upward and downward, and forward and backward, over the flank and the lower part of it, until I heard—and which I should do in a great majority of cases—the pulsations of the fœtal heart. I should recognise it by their quickness, the pulsations of the fœtus being double, or more than double, those of the mother.

"If it was a mare, I would have a halter put on her, and an assistant should hold up one of her legs, while some person interested reached under, or, perhaps, knelt under the belly of the mare, and, passing one ear along an imaginary line from between the teats to the chest, and deviating a little from one side to the other, he would then also recognise the quick pulsation of the fœtal heart.

"These observations are addressed to practical men, and will be speedily put to the test by them. The object of the author is to get rid of the vulgar and inefficient methods of detecting pregnancy which are now in general use, and to introduce others that are founded on a surer and more scientific basis."

PRESERVATION OF FOOD. The process of salting, rubbing with nitre, and smoking or drying, is that usually performed by the farmer, and it is successful. The exclusion of air, mechanically or by chemical means, is another certain means of preserving food. Drying perfectly, so as to separate the water necessary for putrefaction, is also a perfect process, and much used in keeping fruits, as dried apples, peaches, &c. Sugar, alcohol, molasses, alum solution, are also serviceable in preserving some kinds of food. They do this by removing their interior water. Coldness and absence of air, or moisture procured by mechanical means, are also sufficient.

PRESERVATION OF TIMBER. Careful drying and preservation from moisture is the commonest process; but, for a perfect preservation, it is necessary to saturate the pores of the wood with metallic salts. This saturation has to be made in a press, and is hence very expensive. The fluids used are solutions of blue vitriol (sulphate of copper), pyrolignite of iron, sulphate of iron, corrosive sublimate. M. Boucherie, three years since, recommended the immersion of the trunks of newly-cut trees in these solutions, which, under these circumstances, rose through the stem and branches to the leaves, and impregnated them thoroughly. The inconvenience of this process for large trees has induced him to modify it to the following:

"The ingenious process of impregnating wood, by the way of vital aspiration, is not without certain objections. In the first place, it can only be performed at those periods of the year when the sap is in motion and the trees are covered with leaves. This time is limited to a few months of the year, and the usual practice being to fell timber in the winter, usage is opposed to cutting down trees in the spring and autumn. To meet these objections, M. Boucherie engaged in new experiments, which led him to a means of impregnating timber at all seasons, in winter as well as spring and autumn, and in a very short space of time; this second method is applicable to wood that has already been squared as well as to the round trunk, provided it has been recently felled.

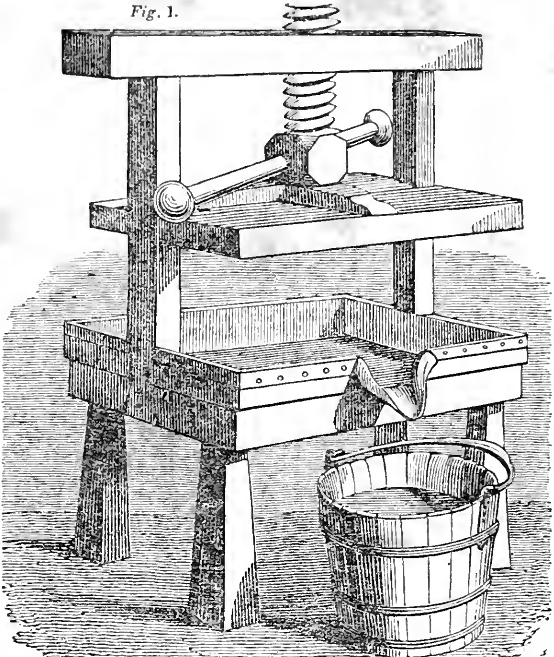
"To impregnate timber by this process, the logs are placed upright, and the upper extremities are fitted with an impermeable sack for the reception of the saline solution destined to charge them; the fluid enters from above, and almost at the same moment the sap is seen to begin running out below. There are some woods which include a large quantity of air in their tissues; in this case the flow does not go on until this air has been expelled: once begun, it goes on without interruption. The operation is terminated when the fluid, which drips from the lower part, is of the same nature as that which is entering above. In my opinion, this method must be preferable to that by aspiration. In the second mode of proceeding, in fact, we accomplish our object by a true displacement; almost the whole of the sap is expelled, and the saline solution introduced has only to subdue or neutralize the very small quantity of soluble organic matter which may remain adhering to the woody tissue. By accomplishing such a displacement by means of simple water, we should undoubtedly obtain results favourable to the preservation of timber, inasmuch as we should have freed it from almost the whole of those matters which are regarded as the most alterable themselves, and the first cause of rotting in timber. The rapidity with which the fluid introduced is substituted for the sap which it displaces, and the quantity of this expelled sap, which may be readily collected, exceeds anything that could have been imagined before making the experiment; thus the trunk of a beech-tree, about 52½ feet in length, by 33¾ inches in diameter, and consequently forming a cube of somewhat more than 29 feet and a half, gave, in the course of twenty-five hours, upward of 330 gallons of sap, which were replaced by about 350 gallons of pyroligneous acid. The liquid which penetrates in this way acts so effectually in displacing the sap, that M. Boucherie says we can readily procure or extract by its means the saccharine, mucilaginous, resinous, and coloured juices contained in trees. It would, perhaps, be possible—and I beg to suggest this idea to colonial planters—to apply the method of displacement to the extraction of the colouring matters of dye woods."

PRESS FOR CIDER. The common press is represented in the figure at the head of the following page; a rougher press, made by means of a lever, is also much used.

PRESS FOR OILS. See *Oils*.

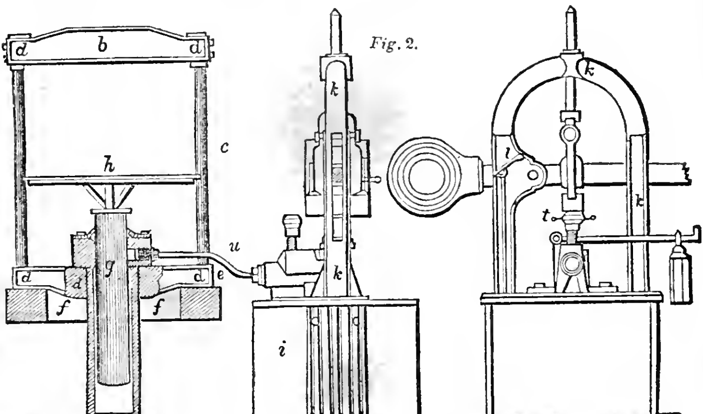
PRESS, HYDRAULIC. "The framing consists of two stout cast-iron plates, *d*, *d*, which are strengthened by projecting ribs, not seen in the section, *Fig.* 1. The top, or crown plate, *b*, and the base plate, *d*, *d*, are bound most firmly together by four cylinders of the best wrought iron, *c*, *c*, which pass up through holes near the ends of said plates, and are fast wedged in them. The flat pieces, *e*, *e*, are screwed to the ends of the crown and base plates, so as to bind the columns laterally. *f* is the hollow cylinder of the press, which, as well as the ram, *g*, is made of cast iron. The upper part of the cavity of the cylinder is cast narrow, but is truly and smoothly rounded at the boring mill, so as to fit pretty closely round a well-turned ram, or piston: the under part of it is left somewhat wider in the casting. A stout cup of leather, perforated in the middle, is put upon the ram, and serves as a valve to render the neck of the cylinder water-tight, by filling up the space between it and the ram; and since the mouth of the cup is turned downward, the greater the pressure of water upward, the more forcibly are the edges of the leather valve pressed against the inside of the cylinder, and the tighter does the joint become.

Fig. 1.



"Upon the top of the ram, the press-plate or table, h, rests; it is called the follower, because it follows the ram closely in its movements.

Fig. 2.



"*k*, *k* (*Figs.* 1 and 2) is the framing of a forcing pump, with a narrow barrel; *i* is the well containing water to supply the pump. *Fig.* 3 is

Fig. 3.

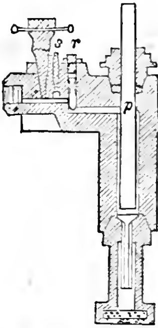
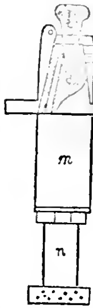


Fig. 4.



a section of the pump and its valves. The pump, *m*, is of bronze; the suction pipe, *n*, has a conical valve with a long tail; the solid piston, or plunger, *p*, is smaller than the barrel in which it plays, and passes at its top through a stuffing-box, *q*; *r* is the pressure-valve, *s* is the safety-valve, which, in *Fig.* 2, is seen to be loaded with a weighted lever; *t* is the discharge-valve, for letting the water escape, from the cylinder beneath the ram, back into the well. See the winding passage in *Fig.* 4. *u* is the tube which conveys the water from the pump into the press-cylinder. In *Fig.* 2 two centres of motion for the pump lever are shown. By shifting the bolt into the centre nearest the pump rod, the mechanical advantage of the workman may be doubled. Two pumps are generally mounted in one frame for one hydraulic press: the larger to give a rapid motion to the ram at the beginning, when the resistance is small; the smaller to give a slower but more powerful impulsion when the resistance is much increased. A pressure of 500 tons may be obtained from a well-made hydraulic press with a ten inch ram, and a two and a one inch set of pumps"—(*Ure.*)

PRICKING. The same as nicking, which see.

PRICKING OUT. Thinning plants in drills, &c.

PRICKLE. A sharp thorn, produced by a thickening of the bark or skin of the plant.

PRIMÆ VIÆ. The passage through the bowels.

PRIMARY ROCKS. The unstratified, crystalline rocks, as granites. Sometimes the transition slates and stratified rocks are included in this term.

PRIMINE. The outermost covering of the ovule; afterward it becomes the skin, or testa, of the seed.

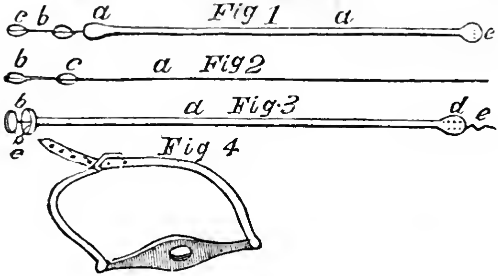
PRIMROSE. Pretty flowering perennials of the genus *Primula*.

PRISM. "A solid contained by planes, of which two that are opposite are equal, similar, and parallel, and all the rest parallelograms. Prisms take particular names from the figures of their ends, or opposite, equal, and parallel sides. When the ends are triangles, they are called triangular prisms; when the ends are square, square prisms; when the ends are pentagonal, pentagonal prisms; and so on. A *right* prism has its sides perpendicular to its ends; an *oblique* prism is that of which the sides are oblique to the ends. The solid content of a prism is found by multiplying the area of the base into the perpendicular altitude; hence all prisms are to one another in the ratio compounded of their bases and altitudes." The optical prism is of three similar sides.

PRISMATIC COLOURS. Light passing through a prism is divided into seven colours, called the *prismatic spectrum;* these colours are, in their order, red, orange, yellow, green, blue, indigo, violet. They have each peculiar chemical properties.

PRIVET. *Ligustrum vulgare.* A small shrub with pretty white flowers and black berries, used as an ornamental hedging in gardens. They are readily propagated by seeds, layers, or cuttings.

PROBANG. Œsophagus tube. See *Ox.* The tubes (see *Fig.*) are of leather, covering a spring; they are sometimes hollow, and contain a sti-



lette. *b*, *Fig.*, represents the mouthpiece to keep the jaws open; it is fixed between the teeth, and kept in its place by the strap. The probang is introduced through the hole in the wooden centre-piece, or gag. In *c* the stilette has a corkscrew end, which can be made fast in substances which obstruct the gullet, and will enable the farmer to pull them upward.

PROBE. A wire of silver, with a blunt or sharp point, used to ascertain the depth of wounds, sinuses, &c.

PROBOSCIS. A trunk, or nasal projection.

PROCESS. In descriptions, a tumour or eminence on a bone or part. A projection.

PROCUMBENT. Laying on the ground.

PROGNOSIS. A conclusion respecting the termination of a disease.

PROLAPSUS. A falling out or protrusion of any part of the body; as of the intestines, womb.

PROLEGS. The imperfect legs of caterpillars.

PROMUSCIS. The suctional organ of the hemiptera.

PROPAGATION. Seeds are the most general means of propagation, but they do not perpetuate many improved varieties, especially of fruits; buds do, however. Buds are propagated by *budding*, *grafting*, setting slips, cuttings, layers, offshoots, suckers, and in some plants, as the strawberry, by natural runners. The bulb is a peculiar bud, which also propagates varieties by offsets. Tubers, or rhizomes, are underground stems, as in the potato, dahlia, flag, and they propagate the varieties also. "Cuttings are portions of shoots, either of ligneous or herbaceous plants; and they are made of the young shoots with the leaves on, or of the ripened wood either with or without its leaves; and after they have, either in an herbaceous state with the leaves on, or with the wood mature, and with or without the leaves, been properly prepared and planted, they form roots at their lower extremity, each cutting becoming a perfect plant. In general, cuttings should be taken from those shoots of a plant which are nearest the soil; because, from the moisture and shade there, such shoots are more predisposed to emit roots than those on the upper part of the plant. The young, or last-formed shoots, are to be taken in preference to such as are older, as containing more perfect buds in an undeveloped state, and a bark more easily permeable by roots; and the cutting is to be prepared by cutting its lower extremity across at a joint, the lenticells, or root-buds, being there most abundant. When the cutting is planted, the principal part of the art consists in making it quite firm at the lower extremity, so as completely to exclude the air from the wounded section. Cuttings emit roots at this section, either in consequence of the action of the accumulated sap in the cutting, as in the case of the ripened wood in deciduous trees and shrubs; or in consequence of the joint action of the accumulated sap and of the leaves, as in the case of cuttings of soft wood with the leaves on, and in a living state. A few plants are propagated by cuttings of the leaves, the petiole of the leaf being slipped off from the parent plant, and probably containing the latent embryos of buds. Grafting and budding are processes which have been already explained. Inarching may be described as a species of grafting, in which the scion is not separated from the parent plant till it has become united with the stock."

PROPEDS. The same as prolegs.

PROPHYLACTIC. Preventing disease.

PROPORTIONS, CHEMICAL. See *Equivalents* and *Atom*.

PROSENCHYMA. Elongated cellular tissue, as that of woody structures.

PROTEIN. The pure basis of the animal principles: it is separated from albumen, or fibrin, by dissolving them in caustic potash, and precipitating by acetic acid. It is gelatinous, gray; when dry, semitransparent, and insoluble. Its composition is C 55·7 . H 6·8 . N 16·1 . O 21·2; formula (Mulder) C_{40} H_{31} N_5 O_{12} (Liebig construes the composition into C_{48} N_6 H_{36} O_{14}); symbol Pr. It is a body of great interest, since in its combinations with sulphur, phosphorus, ammonia, &c., most animal tissues are formed. Thus 10 Pr. + sulphur, ½ phosphorus, is albumen. 10 Pr., 2 sulphur, ½ phosphorus, is another form of albumen.

PROTOTHORAX. The first segment of the thorax in insects.

PROTO-SALTS. Oxides; compounds, the bases of which are combined with but one equivalent of oxygen.

PROTOZOA. The lowest animalcules.

PROTRACTOR. "A mathematical instrument for laying down angles on paper, used in surveying, plotting, &c.

"In its simplest form, the protractor consists merely of a semicircular limb of metal divided into 180°, and subtended by a diameter, in the middle of which is a notch to mark the position of the centre. On placing this notch over the angular point, and laying the diameter along a given straight line, an angle of any number of degrees may be made by marking the point on the paper which coincides with the given degree on the limb, and joining this point with the centre when the instrument is removed. The protractor is rendered more commodious by transferring the divisions to the edge of a parallel ruler.

"When a survey is to be plotted on a large scale, and it becomes necessary, in consequence, to lay down the angles with considerable precision, a more complex apparatus is required. The most approved form of the protractor may be described as follows: It consists of an entire circle, connected with its centre by four radial bars. The centre of the metal is removed, and a circular disk of glass fixed in its place, on which are drawn two lines crossing each other at right angles, the point of intersection denoting the centre of the protractor. Round the centre, and concentric with the circle, is fitted a collar carrying two arms, one of which has a vernier at its extremity adapted to the divided circle; and the other a milled head, which turns a pinion working in a toothed rack round the exterior edge of the instrument. The rack and pinion give motion to the arms, which can thus be turned quite round the circle, and set the vernier to any angle that may be required. Each of the two arms is prolonged beyond the edge of the protractor, and carries a fine steel pricker, which is pressed down when the instrument is placed in its required position, and makes a small puncture in the paper. It is essential that the points of the two prickers and the centre of the instrument be accurately in the same straight line."—(*Simms on Mathematical Instruments.*)

PROTUSILE. Capable of being protruded and withdrawn.

PROVENDER. Dry food. See *Fodders*.

PROXIMATE ANALYSIS. The separation of a compound organic body into its several complex parts, as the flour of wheat into starch, sugar, gum, fibrin, gluten, albumen. These are also called *proximate principles*. This kind of analysis is made by means of solvents, as alcohol, ether, water, potash, and acids: it is coarse and unsatisfactory.

PRUNING. "The art of cutting off parts of plants, and more especially of trees and shrubs, with a view to strengthening those which remain. or of bringing the tree or plant into particular forms, calculated to increase particular products. Pruning, therefore, varies according to the kind of plant or tree to be pruned, and according to the object in view. In the case of forest-trees, the general object of pruning is to increase the quantity of timber in the trunk by diminishing the side branches, commencing at the lower part of the tree when it is quite young, and gradually advancing upward as the tree increases in growth. In the case of hedges, the object is to produce a dense mass from the ground upward, which is effected by shortening the side branches. In the case of pruning trees which are cultivated for the sake of their fruit or blossoms, the object is to thin out the branches so as to admit the light and air more freely to their leaves and blossoms, and to concentrate and increase the nourishment to the branches which remain. In the case of trees or shrubs cultivated for the beauty of their shapes, whether natural or artificial, the object of pruning is to deprive the trees or shrubs of all those branches which deviate from or interfere with the natural shape, or with the form which is intended to be produced by art. In pruning with a view to produce fruit, it is necessary to know on what description of branches and buds the fruit is produced. In some trees, as in the peach, it is generally produced on the wood of the preceding year; in others, as in the apple and pear, it is generally produced on wood of two years' growth; and in the vine it is produced on shoots of the current year. The general effect of pruning on plants is to increase their longevity; since the tendency of all vegetables is to exhaust themselves, and, consequently, to shorten their duration, by the production of seeds. In the operation of pruning, the shoots are cut off close to the buds, or at a distance from them not greater than the diameter of the branch to be cut off; because, without the near proximity of a bud, the wounds will not heal over. In shoots which produce their buds alternately, the cut is made at the back of the bud, sloping from it, so as that it may be readily covered by bark in the same or in the following year. This is readily done with a pruning knife, by a slanting cut, made at an angle of 45° with the direction of the branch; but in the case of branches where the buds are produced opposite each other, either one bud must be sacrificed, or the branch must be cut off at right angles to its line of direction, and is more conveniently done by the pruning shears. The operation of pruning may, in many cases, be superseded by rubbing off, or pinching out the leaf-buds, so as to prevent superfluous shoots from being produced."—(*Lindley.*)

Where bleeding occurs in summer pruning, the stem should be first pinched by the thumb and finger, to destroy the tissues, and removed when dead: in this way vines and figs may be pruned at any time. The best time for pruning trees is in June and July, when the wounds heal readily.

PRUNING KNIFE. "A knife the blade of which has a straight edge, formed of well-tempered steel, and of no great breadth, with a narrow point, in order that it may be more readily introduced among crowded branches. Formerly, pruning-knives were hooked at the point; but the cuts made by such knives had a tendency to crush the shoot, and leave a rough section, more readily injured by the air and water, and less likely to be speedily healed over. Such knives, when of a large size, were called pruning hooks.

PRUNING SHEARS. Shears in which one of the blades moves on a pivot, which works in an oblong opening instead of a circular one, by which means a draw cut is produced similar to that effected by a knife, instead of the crushing cut produced by common shears, which fractures the section left on the branch, and renders it liable to become diseased, or to decay, instead of being covered over with fresh bark. Pruning shears are particularly adapted for cutting spiny or prickly shrubs, such as the different species of thorns, gooseberries, or roses.

PRUSSIC ACID. Hydrocyanic acid. See *Cyanogen*. It is distilled from many flowers and seeds, which owe their odour to it, as peaches, cherries, apple seeds, &c.

PSEUDO. A common prefix, meaning false.

PTYALISM. Increased salivation.

PUBESCENT, PUBESCENCE. Covered with soft hairs.

PUCCOON. American alkanet. *Batschia canescens*. A perennial-rooted plant of the borage tribe, the root of which yields a red pigment, with which the Indians colour themselves.

PUDDINGSTONE. A conglomerate.

PUDDLING. Ramming clay with sand and water until it is converted into an impervious mortar.

PUERPERAL. Relating to parturition.

PUFF-BALL. The genus *Lycoperdon* yields numerous puff-balls. The dust was at one time used to stop bleeding from wounds, as a styptic.

PUGGING. The stuff laid between floors to deaden sound.

PUGIL. A pinch of any stuff.

PULMONARIES. A kind of spider.

PULMONARY. Relating to the lungs.

PULQUE. The fermented juice of the Mexican aloe (*Agave Americana*).

PULSE. Leguminous crops.

PULVILLI. The hairs, or a membrane, which covers the feet of some insects, enabling them to walk on the ceiling of rooms against gravity.

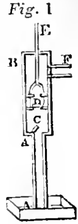
PUMICE. Porous lava. It consists of silica, 77·5; alumina, 17·5; potash and soda, 3·0; oxide of iron, 1·75.

PUMICED FOOT. In farriery, a wide-spread hoof, the sole of which is flat with the ground.

PUMP. This machine is of great use on the farm for many purposes. The various forms may often be employed for collecting or distributing fluids. "Though the forms under which this useful engine is constructed, and the mode in which the power is applied, may be modified in an infinite number of ways, there are only three which can be considered as differing from each other in principle. These are the *sucking pump*, the *forcing pump*, and the *lifting pump*, so called from the manner in which they act.

"The *sucking pump*, or common household pump, is an apparatus of which the principle and construction will be evident from the annexed figure. A A is a pipe of any convenient length, the lower end of which reaches below the surface of the water in the well or reservoir; B is a barrel, generally of greater diameter than the pipe; C a valve opening upward; D a piston moved by the rod E: in this piston there is also a valve opening upward. When the piston is raised, the air in the barrel between the valves is expanded, and its tension, consequently, diminished; the pressure of the air in the pipe, therefore, opens the valve C, and the whole air in the pipe and barrel becomes less dense. In this state the atmospheric pressure on the surface of the water causes it to rise in the pipe, until the tension of the confined air becomes equal to the pressure of the atmosphere. On again depressing the piston, the valve in it opens, and the air passes through it from the barrel as it descends; but the valve, C, is closed by the downward pressure, and the volume of water which has entered

Fig. 1

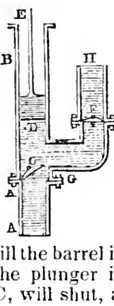


the pipe remains. On again raising the piston, the same effect is repeated, and an additional quantity of water enters the pipe. Thus, by the alternating motion of the piston, a column of water is raised in the pipe until it reaches the piston when at the bottom of the barrel, and the whole of the air below it has been excluded. On raising the piston when the water has reached it, the fluid will be compelled to follow by the pressure of the atmosphere on its surface in the well. When the piston is again depressed, the water flows through the valve in it, and ascends into the barrel, and by the succeeding strokes of the piston is lifted up until it reaches and flows out of the spout, F.

"Although in theory the limit of the height to which water may be raised by the sucking pump, from the surface of the fluid in the well to the highest position of the moveable piston, is about thirty-four feet (the height of a column of water which balances the pressure of the atmosphere), it is not found practicable, with pumps of the ordinary construction, to raise it more than about twenty-eight feet. The difference arises from the difficulty of making the apparatus absolutely air-tight.

"The *forcing pump* is represented in *Fig.* 2. The piston-rod, E D, is attached to a solid plunger, D, adjusted to the cavity of the barrel. A pipe, G H, furnished with a valve, F, opening outward, communicates with the barrel at G. On elevating the plunger, D, the water will ascend through the valve, C, in the same manner as in the sucking pump, till the barrel is filled to D. Now when the plunger is depressed, the valve, C, will shut, and the water between D and C be forced through the valve F into the pipe G H. When the plunger is raised, the valve at F shuts, the pressure on its under side being removed, so that the water which was forced into the pipe by the previous stroke cannot return into the barrel. At the next stroke of the piston more water is again forced into the pipe, and so on till it is raised to the height required.

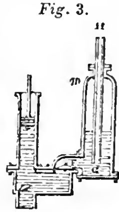
Fig. 2.



"In this pump the pipe, A A, may be dispensed with, and the barrel, B, immersed in the reservoir; in which case the action of the pump is independent of the atmospheric pressure, and could be maintained equally well in a vacuum.

"In order to produce a continued stream through the pipe, G H, an air vessel, *m n*, may be attached to the lateral branch above the valve F, *Fig.* 3. The pipe, G H, reaches to near the bottom of the air-vessel; and when the water has been forced into the vessel by the action of the pump, until it reaches above the lower end of the pipe at G, it is evident that, as all communication is then cut off with the external atmosphere, every additional quantity of water thrown into the vessel will tend more and more to compress the air within it, which, acting by its pressure on the surface of the water, forces it through the pipe, G H, in a continued stream.

Fig. 3.



"The *lifting pump* is represented by *Fig.* 4. The barrel of the pump is immersed in the water and fixed to an immoveable frame. The piston, with its bucket and valve, C, opening upward, is attached at E to another frame, G H I K L, consisting of two strong iron rods, H I and L K, which move through holes in framework to which the pump is fixed. An inclined branch, M N, either fixed to the top of the barrel, or moveable by means of a ball and socket, is fitted exactly to the barrel, and furnished with a valve at M. Suppose the barrel im-

Fig. 4.

mersed in the water to a certain depth: if the piston frame be now thrust down by the handle at G, the piston will descend, and the water be forced by its upward pressure through the valve C, so as to maintain the same level in the pump as in the well. But when the piston frame is elevated, the valve C will shut (as shown in the figure), and the water above C be *lifted up* with the piston, and forced through the valve M into the branch, M N, from which its return will be prevented by the shutting of the valve M when the piston descends.

"In each of these different kinds of pumps which have been described, the total effort required to work the machine, independently of friction, is equal to the weight of a column of water, the base of which is equal to the area of a section of the working barrel, and the altitude equal to the distance between the surface of the water in the reservoir and the point to which it is raised. In the sucking pump the whole of this effort is expended in raising the piston; in the forcing pump one part is expended in raising and the other in depressing the piston, and it is advantageous to dispose the machinery so that these two parts shall be nearly equal. In small pumps for domestic purposes, the strength of man is usually employed as the moving power; but in raising water from great depths, as the bottom of mines, the steam-engine is applied to this purpose."—(*Brande's Encyclopædia.*)

PUMPKIN. *Cucurbita pepo.* The best varieties are the family, mammoth, Connecticut field, white bell, Valparaiso. They are cultivated like melons, but may be planted in corn-fields. They are kept during the winter by placing them on shelves in a cellar where the temperature is uniform and not below the freezing point. They form admirable food for stock, and are extensively employed in the West to fatten hogs.

PUNCHEON. A measure of 84 gallons; a short post.

PUNCTATE. Dotted.

PUPA. A nymph, grub, or chrysalis.

PUPIPARES, PUPIPARA. Those insects are said to be pupiparous which produce their young in the condition of a pupa or nymph, as the forest fly (*Hippobosca equina*).

PUPIVORES, PUPIVORA. The name of a tribe of hymenopterous insects, comprehending those of which the larvæ live parasitically in the interior of the larvæ and pupæ of other insects.

PURGATIVES. Medicines which produce purging. See *Pharmacopœia.*

PURGING. Often used for diarrhœa or over-purging. See the animals respectively.

PURIFORM. Like pus.

PURLINE. In building, a piece of timber lying on the principal rafters to support them in the middle.

PURPURIC ACID. A red compound produced by the action of nitric acid on uric acid.

PURSIVENESS, PURSINESS. Shortness of breath.

PURSLANE. *Portulacca oleracea.* An annual with succulent leaves, partially cultivated as a salad and pot-herb.

PUS, MATTER. A yellow, cream-like fluid formed in abscesses and from wounds. It contains globules, and is blood modified by inflammatory action.

PUTAMEN. The shell of a fruit. The endocarp.

PUT LOGS. Short timbers used in scaffolding.

PUTREFACTION. The fœtid decomposition of animal and vegetable substances containing much nitrogen. The bad odours are due to the formation of compounds of sulphur and ammonia with sulphuretted hydrogen. Putrefaction can only take place when oxygen is present with moisture, and a temperature above 32° Fahrenheit. Everything which hinders the accomplishment of these conditions hinders putrefaction, as drying, salting, coldness, placing in air-tight vessels. Saline substances hinder putrefaction by either coagulating and changing the nitrogen compound, or withdrawing the water by their greater affinity.

PUTTY. In building, a fine cement of lime only. In glazing, a compound of drying oil, linseed oil, and whiting.

PYLORUS. The passage or valve of the stomach into the intestines.

PYRITES. Native sulphurets of iron or copper.

PYRO (from πυρ, *fire*). A common chemical prefix, indicating compounds modified by the action of heat, as pyrophosphoric, pyrotartaric acids.

PYROACETIC SPIRIT. A volatile, inflammable, and limpid fluid, formed by the distillation of acetate of lead. It is also called acetone.

PYROLIGNEOUS ACID. The vinegar (acetic acid) procured by distilling wood. It contains creasote and other tarry compounds, but is extensively used to form solution of iron or red liquor for dyers. Its compounds are called pyrolignites.

PYROLIGNEOUS SPIRIT, PYROXYLIC SPIRIT. Hydrate of mythylene, wood naphtha, a very volatile, inflammable fluid, from distilled wood, sometimes used for lamps. It is one of the most powerful antiseptics, but of an unpleasant odour.

PYROMETER. An instrument for measuring degrees of heat above 600° Fahr. They are all very imperfect except Daniel's, and seldom used.

PYROSIS. Acidity of the stomach, with a discharge of hot fluid into the throat and mouth.

PYROXENE. Augite.

PYROXYLIC SPIRIT. Pyroligneous spirit

PYXIDIUM (from πυξις, *a small box*). A fruit which splits into an upper and lower half, as that of the pimpernel.

Q.

QUADRICORNES. A family of wingless insects, with four antennæ.

QUADRIFID. Four-cleft.

QUADRILATERAL. Four-sided.

QUADRIPENNATES. A tribe of insects with four membranous wings.

QUAGGA. A quadruped allied to the zebra.

QUAGMIRE. A muddy, soft bog or marsh.

QUAIL. The genus *Coturnix*. Birds like the partridge, but of passage.

QUAKING GRASS. The genus *Briza*.

QUART. The fourth of a gallon.

QUARTAN. An intermittent fever, appearing every fourth day.

QUARTER. Eight bushels, a fourth part.

QUARTZ. Silica, silicic acid crystallized, rock crystal.

QUARRY. A pit or excavation, from whence stones are taken, by blasting or otherwise.

QUASSIA. A bitter wood, from the *Q. excelsa* of South America. A strong decoction, sweetened with sugar, is a certain and safe poison for flies.

QUEEN POST. In building, an upright post in a roof for suspending the beam when the principal rafters do not meet in the ridge.

QUERCITRON BARK. The inner bark of the black oak. See *Oak*.

QUICKLIME. Caustic, fresh-burned lime.

QUICKSILVER. Mercury.

QUICKS. The young white thorns.

QUICKSET HEDGE. A hedge of white thorn.

QUINATE. Five-parted.

QUINCE. *Cydonia vulgaris*. A well-known fruit, readily cultivated from seed, cuttings, and suckers. The stocks are much used for working pears and apples, which they bring forward, but render short-lived. The Portuguese, eatable, orange, and musk kinds are most esteemed; the Chinese is very long.

The quince prefers a moist, loose soil; it requires little pruning, except the removal of suckers. The fruit is chiefly used for preserves.

QUINCUNX. In the following order ⁙, with one at each corner, and a fifth in the centre of the square

QUININE. The active principle of Peruvian bark, a white, crystalline alkaloid.

QUINOA or PERUVIAN RICE.

Chenopodium quinoa. A plant of the Andes, similar to the goosefoots, the leaves of which are used as spinach. The seeds are very nutritious, and are eaten boiled in soups.

QUINSEY. "Inflammation of the tonsils. This is common inflammatory sore throat: it is not infectious. It begins with pain on one side of the throat, and swelling of the tonsil, attended by febrile symptoms, which sometimes run high, especially as the tumefaction advances; there is great restlessness and anxiety, and often the utmost difficulty of swallowing even liquids, and of breathing. The disease has proved fatal by producing suffocation, but it generally terminates in resolution or suppuration: in the latter case the abscess breaks, and a good deal of pus is discharged, and the patient is at once relieved of all his urgent symptoms; but it occasionally happens that the other side of the throat becomes affected, and goes through the same stages."

QUITCH GRASS. Couch grass.

QUOIN. The corner of a building.

R.

RABBET. A moulding.

RABBIT. *Lepus cuniculus.* A well-known rodent. They breed at six months, and have seven to eight young in a litter. They devour the young, green vegetation of the farmer, but are readily kept, and yield an abundant supply of food. The dung is of the same character as that of sheep.

RACEME. A form of inflorescence, consisting of a main stem with stalked flowers arranged along it.

RACEMIC ACID. An old name for a form of tartaric acid; the paratartaric acid.

RACHIS. An upright axis of inflorescence.

RACK. A railed space above the manger, in which grass is placed. Below should be a box to collect the grass seeds. The rack should not be placed above the animal's head; for the dust of the hay, falling into his eyes, may produce irritation, and, ultimately, blindness. This is, indeed, one of the chief causes of the blindness of horses.

RACKING FLUIDS. Decanting; separating the clear portions from the dregs. The barrel into which the fluid is racked should be perfectly clean and fumigated with sulphur.

RADIANT. A luminous spot or body.

RADIATION. The emission of rays of heat or light through air or space, whereby little is lost.

RADICAL. A base in chemistry. Compound radical is a compound base in organic bodies.

RADICLE. The miniature root of the embryo. Also, small roots.

RADISH. *Raphanus sativus.* An annual cruciferous plant, cultivated for its roots. *Varieties:* Long scarlet, scarlet turnip, white turnip-rooted, long white Naples, purple turnip, white Spanish, black Spanish. The early crops must be forwarded in frames and hot-beds. Warm borders are also selected for crops in May. The seed is sowed broad-cast or in drills nine inches apart. The soil should be light, drained, and moderately fertile. When the crop is large, 10 to 14 lbs. of seed the acre are employed. The leaves are infested by skipping beetles, and should be sprinkled with air-slacked lime, snuff, &c. The roots are also subject to a maggot. The green pods are sometimes pickled, and the young plants used as salad.

RADISH, WILD. The charlock, a weed.

RADIUS. The length of a straight line drawn from the centre to the circumference of a circle.

RADIUS BONE. One of the bones of the forearm.

RAFTER. A timber of the roof.

RAFTERING LAND. Ploughing only half the land, and turning the grass side of each furrow-slice upon an unploughed bed.

RAG. Woollen rags are very useful as a manure. They are chopped fine, and used at the rate of half a ton to the acre. They last four or five years, and advance vegetation, especially the hop. The rags, by decay, become converted into carbonate of ammonia, in the same way as hair and horns, with which manures they are identical.

RAG WEED, GROUNDSEL. Composite-flowered weeds.

RAIL. The horizontal parts of framing. Pieces of timber of 12 feet, used for fencing.

RAIN. The water of *Clouds*, which see. The average amount that falls in this state is 35 inches, the largest amount following southwest and northwest winds. Rain is a true manure, containing carbonic acid, a little ammonia, and saline matters. It is preferable to preserve it in tanks, for watering gardens, than to use well water.

RAINBOW. A display of the prismatic colours in the air, produced by the action of particles of water on the sun's rays.

RAIN GAUGE. An instrument to measure the amount of rain fallen. A convenient form of the instrument

is represented in the annexed figure, where the rain which enters the funnel is collected in a cylindrical vessel of copper, connected with which, at the lower part, is a glass tube with an attached scale. The water stands at the same height in the cylinder and glass tube, and being visible in the latter, the height is read immediately on the scale; and the cylinder and tube being constructed so that the sum of the areas of their sections is a given part, for instance, a tenth, of the area of the funnel at its orifice, each inch of water in the tube is equivalent to the tenth of an inch of water entering the mouth of the funnel. A stop-cock is added, by which the water is drawn off when the observation is made. It should be placed in an open space.

RAISINS. Grapes allowed to dry on the vine. As soon as they are ripe, the leaves are pruned off, and none but sound fruit left. The stalk is also half cut through. When dry, they are plucked, dipped in a solution of lye, and dried on frames.

RAISING PLATE. The timber to which the upper ends of the rafters are nailed.

RAKE. An implement consisting of one or more rows of long teeth, to tear the ground or collect hay, &c. The revolving hay rake is figured under *Hay-making*. The horse-rake is only a large rake drawn by a horse, and furnished with handles to be held by a labourer.

RAM. The male of the sheep. See *Sheep*.

RAMENTA. Thin, brown scales seen on ferns and young shoots.

RAMOSE. Branched.

RAMPIONS. *Campanula rapunculus*. This is cultivated, to a limited extent, for its roots, which are said to be better than radishes. They are cultivated like radishes, and are fit for use in September and the fall. The soil should be rather moist. The roots are eaten raw, in salads, sliced with the leaves, or they may be boiled, and treated as asparagus. Seed is obtained by setting out a few of the last year's roots in spring.

RANIDÆ. The reptiles resembling the frog (*rana*).

RANUNCULUS. Plants resembling the buttercup and crowsfoot. They are vile weeds in meadows, many of them being acrid and poisonous. They have been much improved for the flower garden.

RAPE. *Brassica napus*. "This plant, which is of the cabbage tribe, is cultivated, like cole, or colza, for the sake of its seeds, from which oil is extracted by grinding and pressure. It is also extensively cultivated in England for the succulent food which its thick and fleshy stem and leaves supply to sheep when other fodder is scarce.

"The mode of cultivation of the colza and rape for seed is nearly the same. The colza takes a longer time to come to maturity, and produces more seed. The rape grows on less fertile soils, and may be sowed in spring as well as in autumn. Both are hardy, and resist the winter's frost.

"The seed-bed, where the cultivation is on a small scale, is usually prepared by digging or trenching with the spade in a good loamy soil, neither too sandy nor too wet. A large proportion of rotten dung is spread evenly over it, and dug in six inches deep, and the surface is raked fine. The seed is sowed broad-cast or in drill; the latter is the best method: it is then slightly covered with the rake; and if the ground will allow of it, without risk of its being bound too hard in case of dry weather, it is well rolled or trodden with the feet. The seed must not be sowed too thick; and the plants, as soon as they have six leaves, must be thinned to a distance of four or five inches in the rows, which will make them stronger and better furnished with roots. One acre of seed-bed will furnish plants for ten acres or more. The seed is sowed in July or August, that the plants may not run to seed the same year, which they are apt to do if sowed early; and they are transplanted in September or October, on land which has already borne a profitable crop. As this crop is a substitute for a fallow on rich, heavy land, too much pains cannot be taken to keep it free from weeds. Winter barley and rye, which are reaped early in July, are very proper crops to be succeeded by rape or colza. The stubble should be ploughed two or three times, to pulverize and clean it. A good coat of rotten dung should be put on, and the land ploughed in ridges, as for turnips. The plants should be put in on the ridges ten inches apart. It requires great care, in taking them up, not to break the fibres of the roots; they should be raised with a fork, and placed gently, with the fine earth adhering to them, in flat baskets, and in a slanting position, so that the tops may be upward. In planting, the holes should be made with a large, thick dibble, that the plants may be introduced without doubling up the principal roots or breaking the fibres. The earth should be pressed to the root by a short dibble, inserted to the right or left of the hole made by the first dibble; or, which is better in stiff soils, a hole should be made with a narrow hoe of sufficient depth to allow the plant to be placed in it, and another hoe should follow to draw the earth to the plant. Thus, two men with hoes, and one woman, will plant a row more rapidly than could be done in any other way. The man who fills up the holes places his foot by the side of each plant as he goes on, to press the earth to the roots.

"An expeditious mode of planting rape is used in Flanders. A spade ten inches wide is pushed vertically into the ground, and, by drawing the handle towards his body, the labourer makes a wedge-like opening; a woman inserts a plant in each side of this opening, and when the man removes the spade the earth falls back against the plants. The woman puts her foot between the two plants, and they are then fixed in their places. In this operation the man moves backward; and the woman, who puts in the plants, forward. Instead of the spade, an instrument is also used called a *plantoir*. It consists of two sharp-pointed stakes, a foot or more apart, connected by a cross-handle at top, and a bar at about eight or ten inches from the points. This instrument is pressed into the ground by the handles, assisted by the foot placed on the lower bar, and makes two holes, a foot apart, into which the plants are placed, and earthed round as before. This is done when the land has not been laid up into high ridges.

"When a large field is to be planted, a more expeditious mode is adopted; and this is the most usual practice in Holland and Germany. The land having been prepared, and the manure well incorporated, a deep furrow is drawn with the plough; women follow with baskets of plants, which they set, a foot apart, slanting against the furrow slice. When the plough returns, the earth is thrown against these plants, and a man or woman follows, who, with the foot, presses the earth down upon the roots. Sometimes plants are put into each furrow, which is then ten inches or more wide; but the best cultivators put them only in every alternate furrow. In this case, also, there are no ridges. The season of the year affords sufficient moisture, in the north of Europe, to ensure the growth of the plants; and if they have escaped the fly in the seed-bed, they are now tolerably safe; no farther attention is requisite till spring; the weeds are then carefully extirpated by hand and hoe, and where the distance of the plants admits of it, the light plough stirs the ground between the rows, throwing the earth towards the stems, yet so as to leave each plant in a little basin, to catch the water and conduct it to the roots. When the plants are invigorated with rich liquid manure, such as night soil mixed with water, or the drainings from dunghills, they become extremely luxuriant, and every trouble or expense bestowed upon them is amply repaid. The difference between a crop partially neglected and another carefully cultivated often exceeds fifty per cent.

"A moderate return of seed for colza is thirty bushels per acre; but it frequently exceeds fifty. The value on the Continent is nearly the same as that of wheat. In England it is somewhat less, owing to the quantity imported. It is usually sold by the last of ten quarters.

"There is not much difference between the value of colza and rape seed (called *navette* in French), but the latter produces less. When the rape is transplanted before winter it is much more productive than when sowed in spring. In the latter case it produces seed the same year. It is sowed in drills, and thinned out by the hoe; and in favourable seasons a tolerable crop is obtained. It is generally sowed on land which could not be brought into a proper tilth after harvest, and which would require the frost of winter to mellow it.

"Great crops of cole seed and rape have been produced by merely paring and burning the surface and ploughing in the ashes; and these crops, alternating with oats, have in many instances so exhausted the soil as to cause a great prejudice against them in the minds of the landlords. Many leases have a clause prohibiting its cultivation, except to be eaten green by sheep. The principal cause, however, of the diminution of this crop in England is the inferior price obtained for the seed when compared with wheat, which can be raised on the same land, and is a more certain crop.

"The rape and colza ripen their seed very unequally. The lower pods are ready to burst before those at the top are full. If the season is wet at harvest, much of the seed is lost; and, without great attention, some loss is sustained in the most favourable seasons. It should be cut when the dew is on it, and moved as little as possible. If the weather permits, it is thrashed out on a cloth in the field; and as many thrashers are employed as can be conveniently collected, that no time may be lost when the weather is fair. The seed is spread out on the floor of a granary, that it may not heat, and is turned over frequently. It is then sold to the crushers, who express the oil. The pods and small branches which are broken off in thrashing are much relished by cattle.

"This crop returns little to the land, and is of itself very exhausting. Not so, however, is the rape when sown as food for sheep; it is, on the contrary, a valuable substitute for turnips, upon land which is too wet and heavy for this root. The *Brassica oleracea* is more succulent than the *Brassica napus*. Its stem is not so hard, and the soft pith which it contains is much relished by every kind of live stock. To have it in perfection, the land should be prepared and manured as for turnips. The rape should be sown in drills, ten inches apart, about the beginning or middle of August, which gives ample time for preparing the land without interfering with the turnip crop. It will be sufficiently forward before winter, and it should then be hoed over once. If the crop is very forward, it may be slightly fed off; but, in general, it is best to let it remain untouched till spring. In the end of March and the beginning of April it will be a great help to the ewes and lambs. It will produce excellent food till it begins to be in flower, when it should immediately be ploughed up. The ground will be found greatly recruited by this crop, which has taken nothing from it, and has added much by the dung and urine of the sheep. Whatever be the succeeding crop, it cannot fail to be productive; and if the land is not clean, the farmer must have neglected the double opportunity of destroying weeds in the preceding summer and in the early part of spring. If the rape is fed off in time, it may be succeeded by barley or oats, with clover or grass seeds, or potatoes, if the soil is not too wet. Thus no crop will be lost, and the rape will have been a clear addition to the produce of the land. Any crop which is taken off the land in a green state, especially if it be fed off with sheep, may be repeated, without risk of failure, provided the land be properly tilled; but where cole or rape have produced seed, they cannot be profitably sown in less than five or six years after on the same land.

"When the oil has been pressed out from the seed, the residue and the husk of the seed form a hard cake known by the name of rape-cake. This is used on the Continent to feed cows and pigs with, as we use the linseed cakes; but it is also used as a rich manure. When rape-cake is ground to a powder and drilled with the seed on poor, light lands, it supplies nourishment to the young plants, and greatly accelerates their growth; but if it be added in a large proportion in immediate contact with the seed, on heavy, impervious soils, it often undergoes the putrid fermentation, which it communicates to the seed sown, and, instead of nourishing, destroys it. In this case, it is useful to mix it with some dry, porous earth, or with ashes, which will prevent the too rapid decomposition: sixteen bushels are used to the acre. Dissolved in water, and mixed with urine, it forms one of the most efficacious of artificial liquid manures. Hence it is probable that the most advantageous mode of using it on the land, after it has been dissolved in the urine tank, is to apply it by means of a water cart to the rows where the seed has been already drilled, or some time before it is put in. Where flax is to be sown, this mixture, applied a few days before the seed is sown, so as to allow it to sink into the soil, is considered, in Flanders, as next in value to the emptyings of privies, which with them hold the first rank for producing fine crops of flax. When a crop appears sickly, and not growing as it should do, owing to poverty in the soil, a top dressing of rape-cake dissolved in water, if no urine is at hand, will generally excite the powers of vegetation; and it is highly probable that it may greatly assist the effects of saltpetre or of nitrate of soda, where these salts are applied. The cultivation of rape or cole for spring food cannot be too strongly recommended to the farmers of heavy clay soils."—(*W. L. Rham.*)

RAPE-SEED CAKE. See *Rape.*

RAPHE. A suture. Parts which appear as though they had been united. In botany, the thread passing from the ovule to the placenta.

RAPHIDES. Crystals of oxalate of potash and other salts found in the juice of rhubarbs, docks, and other plants.

RAPTORES, ACCIPITRES. Birds of prey, as the hawk, owl, eagle.

RAREFACTION. The act of diminishing the density of air or other bodies: it is done by the air-pump in the case of air.

RASORES. Scratchers; gallinaceous birds, such as the fowl, turkey, pheasant, &c.

RASPBERRY. *Rubus idæus.* This shrub, in its wild state, is found growing in our mountainous woods and thickets: it flowers in May and June. The root is creeping. The stems are biennial, erect, three or four feet high, branched, round, pale, or purplish, more or less besprinkled with small, straight, slender prickles, frequently rather resembling bristles than prickles, and sometimes altogether absent. Leaves pinnate, of five or three ovate, rather angular, lateral leaflets, serrated or cut, and angular, green, and nearly smooth above, very downy beneath, and a larger terminal leaflet. The footstalks are furrowed, downy, and prickly, with narrow lateral stipules. The flowers are small, white, or pinkish-white, pendulous, in drooping terminal clusters. Fruit crimson, of numerous juicy grains, beset with the permanent styles, and highly fragrant, with a very deliciously-perfumed, sweet, and acid flavour, more exquisite in the wild state, in general, than when cultivated.

"The wood of the raspberry bush produces fruit but one year, therefore that should be carefully cut down below the surface of the earth, and the young shoots should be shortened to about two feet high; and not more than three or four shoots should be left to each root, as these will produce a greater number of berries, and larger fruit, than would be obtained if twice that number of suckers were left. The middle or end of October is the proper time for this pruning. The fruit is produced from young branches out of the last year's shoots or suckers. The plants raised by layers are much preferred to those taken from suckers; they should also have plenty of room, for when there is not space for the air and light to pass between the rows, the fruit will be small, and will not ripen well. They require a fresh, strong loam, deeply trenched and well manured in the first instance, for in warm, light ground they produce but little fruit.

"The following selection is recommended for a small garden: Barnet, Cornish, double-bearing red Antwerp, Williams's preserving yellow Antwerp."—(*Johnson.*)

RAT. *Mus rattus.* "Few animals are more destructive of every kind of grain than rats. When a barn is infested with them, it is scarcely possible to get rid of them. They will leave it for a time, and the farmer imagines that they are all destroyed; but no sooner is the corn brought in than they resume their depredations. There are means, however, of destroying them, and some of these means are equally effectual and ingenious. The most obvious way of destroying rats is to poison them, which appears an easy matter; but it is not so without an accurate knowledge of the habits of these creatures. Their sense of smelling is more acute than we can well conceive, and their caution is not easily deceived. It is difficult to entice them with food when they have plenty of grain to satisfy their hunger. Patience and perseverance alone can lull their caution to rest.

"The principle on which all ratcatchers proceed is to entice the rats to some particular spot convenient for their future operations. There are some strong scents which these animals seem to delight in, and by means of these their natural sagacity is deceived. Oil of rhodium, of caraway, or anise seed, and musk, are great favourites with rats. Rags impregnated with these, and which have not been in contact with any part of the body of a man, being laid, as if by accident, will induce them to come out of their hiding-places in the night, and frequent the spot where the smell attracts them. Gradually they will become familiarized with the place; and pieces of tallow, or cheese, or malt-dust may be placed near without exciting their suspicion. After they have been fed for a time, they will readily eat anything that may be thrown down, provided it has not been touched by the hand without the covering of a glove properly scented. It will take some time to accomplish this; and when they are to be poisoned, a quantity of poisoned food, similar to what they have been accustomed to feed on, must be prepared, sufficient to poison all those which are supposed to frequent the place. The poisons commonly used are arsenic, nux vomica, powdered Spanish flies, and cocculus indicus, which intoxicates them, so that they may be taken by the hand. A small chamber, or a large chest or box, is convenient to collect the rats; and in order to induce them to go in, pieces of toasted cheese, or red herring, are trailed along the ground from the rat holes to the place where it is wished that they should assemble. As soon as they have been accustomed to find food which they like, they will all come to it in the night; and they can be poisoned, or caught by some contrivance by which the only entrance to the place or box can be suddenly closed. When traps are set, they should be left open for a time, and the rats allowed to go in and out without hinderance, till they crowd together in them, and can be taken in great numbers. When rats have been caught in a trap, and have soiled it with their excrements, it should not be washed nor much handled: it should be left in the same spot as long as any rats are caught. Any change of position excites their caution. An ingenious trap is made by stretching a piece of parchment over the open end of a cask, and enticing the rats to eat the food laid upon the parchment. When they have evidently been there to feed, cross cuts, a few inches long, are made in the parchment with a penknife; and in the bottom of the tub, which has four inches of water in it, a brick is set on its edge, so as to rise just out of the water. The rats coming for food, as usual, some one soon slips through the parchment, and, falling into the water, seeks refuge on the brick; as more fall in, they fight for the possession of the brick, and their noise attracts all the rats within hearing. Thus it is said that a great number may be caught in one night."

RATCHET. A small lever which plays into the teeth of a ratchet-wheel, and allows it to turn freely only in one direction.

RATTLESNAKE. Snakes of the genus *Crotalus*. Their bite is extremely venomous. The wound should be cut out and scarified, and the patient sustained by brandy and ammonia.

RATTLESNAKE ROOT. Senega root.

RAT'S TAIL. A disease in horses, in which the hair of the tail is permanently lost.

REAPING. "The common reaping-hook, or sickle, with which grain is cut, is one of the oldest instruments of husbandry. In reaping with it, a portion of the stems is collected with the left hand and held fast, while the sickle in the right hand is inserted below the left, taking the stems in its semicircular blade, and cutting them through by drawing the sickle so as to act as a saw, for which purpose the edge is finely serrated in a direction from the point to the handle. The heads of the grain, with the upper part of the straw, are then laid on the ground in quantities, which may readily be collected into a sheaf. Practice soon gives dexterity to the reaper, and he finds it more expeditious to cut small quantities in succession, until he has filled his hand, than to attempt to cut through a large handful at once. Severe wounds are often inflicted on the fingers of the left hand by beginners, even to the loss of a finger; but this soon makes them cautious and expert. The division of labour is introduced with advantage among a band of reapers. A certain number cut the grain, while others follow to gather the sheaves; some only preparing the bands, and others tying them and setting up the sheaves into stooks, or shocks, which usually consist of ten or twelve sheaves. The smaller the sheaves are, the less injury the grain sustains in a wet harvest, as the moisture in a thick sheaf does not so readily evaporate. Hence it is the interest of the farmer to see that the reapers do not make the sheaves too large. In many places there is a regular measure for the circumference of a sheaf, which should never exceed thirty inches The bands are made by taking two small handfuls of the cut grain and crossing them just below the ears into a knot. The sheaf is then pressed with the knee, and the band drawn tightly around it. The ends are twisted together like a rope, and inserted under the band, which effectually fastens it. This operation is soon learned, and is done very rapidly. The sheaves should be so tied that there may be no danger of their falling loose when pitched into the cart or stacked, without being so tight as to prevent the moisture in the straw from evaporating. They should not be tied too near the ears, but rather nearer to the butt. The sheaves, when tied, are placed two and two on the butt ends, with the ears leaning against each other: sometimes they are placed in a circle, all the ears being together, and the butts slanting outward: a sheaf is then opened by inserting the hand into the middle of the ears, and reversed over the tops of the preceding, forming a cone, and covering all the other ears, while it hangs down around them. In this position they will bear much rain without injury. It is a good practice to place the shocks across the furrows between the stitches or lands, so as to allow the air to circulate more freely around them. In this case four or five sheaves are placed in a row, leaning against as many in a parallel row, and two sheaves, being opened, are reversed over them to protect the ears. Whatever be the mode adopted in reaping the corn, the same kind of sheaves are formed, and set up in shocks.

"Wherever the sickle is used for reaping, the straw is cut at a certain height from the ground, and the remainder forms a long stubble, which may be mown at leisure after harvest, and carried into the yard for litter; but in the neighbourhood of large towns, where straw is sold at a good price, or exchanged for stable dung, it is important that as much as possible of it should be cut with the grain. This has introduced the practice called fagging. The instrument used for this purpose partakes of the nature of a scythe, as well as of a reaping-hook. It is shaped like a sickle, but is much larger and broader, and, instead of being indented like a saw, it has a sharp edge like a scythe, which is renewed when blunt by means of a stone or bat. The fagging-hook cuts the straw close to the ground by a stroke of the hand; and its curved form is only useful in collecting stray stems, and holding a certain quantity of them between it and the left hand of the reaper when he makes up a sheaf. A certain quantity is cut towards the standing grain, the left hand pressing it down at the same time. When as much is thus cut as would make half a small sheaf, the reaper comes backward, cutting in a direction at right angles to the first, and rolling together the two parts, which he carries in the bend of his hook and places on the band which had been prepared for him. A full-sized sheaf is usually composed of two cuttings. Two men will fully employ a third to make bands for them, tie up the sheaves, and set them up. This method of reaping is laborious, on account of the stooping required to cut near the ground. The Hainhault scythe does the work better, and with less fatigue; it is, in fact, a fagging-hook, not quite so curved, of which the handle is longer, and placed at an angle with the plane of the blade. It requires some practice to give the proper swing to it by a peculiar motion of the wrist; but when this is once acquired, a considerable saving of labour and time is effected. A better instrument, however, on extensive farms, is the cradle-scythe, which, in the hands of an expert mower, will do more work, and more effectually secure all the straw, than any other instrument.

"The objection to the great barn room required for so much straw is obviated by the practice of stacking the grain in the open air on proper stands, to keep it dry and out of the reach of vermin. The additional trouble in thrashing is not so great as that of mowing or raking the stubble, which is generally deferred till half of it is lost by decomposition by the air and moisture. When the saving of time is considered, as well as the saving of expense, there seems to be no doubt that on an extensive farm the scythe is far preferable to the sickle for cutting every kind of grain. Barley and oats are usually mown and carried without tying them into sheaves; but this is a slovenly and wasteful practice: by means of the cradle-scythe they may be mown so regularly as to be readily tied into sheaves; and the additional expense will be fully compensated by the saving of all the grain which, being on the outside of the stack, is lost by the depredations of small birds.

"Beans are usually reaped by the sickle, the stems being too strong and too wide apart to admit of the scythe. Where it can be done conveniently, without the soil adhering too much to the roots, it is better to pull them up and tie them in bundles with straw bands, or twine, which will be found both a convenient and economical method.

"Pease are generally reaped by means of two large hooks similar to the fagging hooks, one of which is held in each hand; and the stems, which are generally much interwoven, are partly cut and partly torn from the roots, and so rolled up into a small bundle laid loose, in order that it may dry. Tares are reaped in the same way.

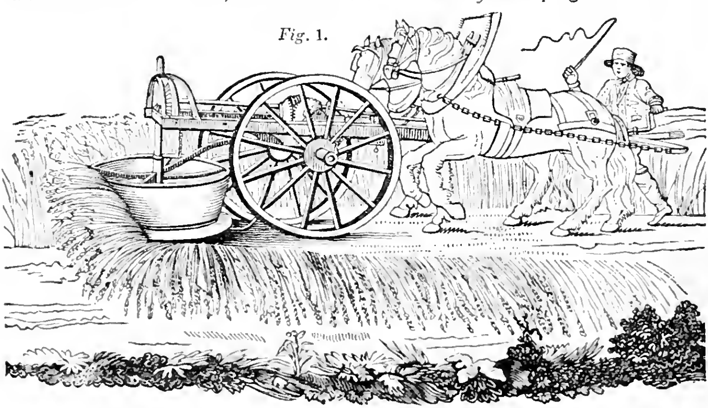
"There have been many attempts to introduce machinery for reaping. Some of the inventions were ingenious and promised well, but none, when put to the test, answered the expectations formed. The various inclinations of the straws prevent any regular mode of cutting. The principle of most reaping machines is that of a revolving edge to cut the straw, and a drum to lay the cut grain down regularly. Whenever the grain is laid or lodged, it is evident that no machine can collect straws lying in every imaginable direction and interwoven with each other. Till some better invention appears, the scythe will probably be found the cheapest and most expeditious instrument for reaping."—(*W. L. Rham.*)

REAPING HOOK. See *Reaping*.

REAPING MACHINE. Several patents have been taken for machines to cut grass and grain crops. One of these, which promised much, is the invention of Mr. Smith, of Deanston, and has been modified and patented by Mr. Wilson in the United States. The original machine is figured below. They have given satisfaction on smooth meadow lands.

Mr. *Hussey's* reaping machine is

Fig. 1.

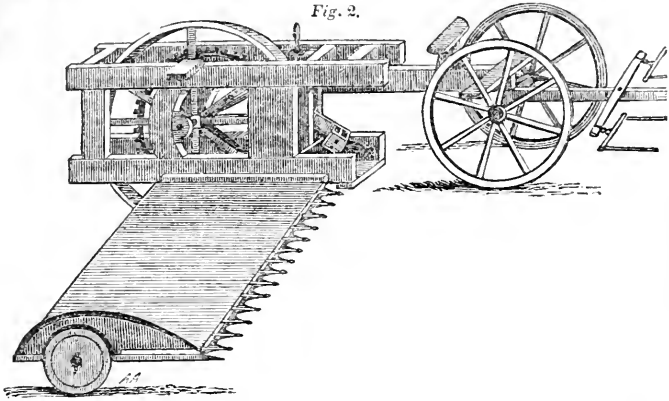


an admirable and durable implement. It has met with considerable applause from several committees, and is used in Delaware, Virginia, and other states. The grain is cut by an arrangement of knives, acting in a way nearly resembling scissors. The prices are $100 and $150. It cuts from fifteen to twenty acres per day. See *Fig.* 2.

Mr. *M'Cormick's* reaping machine has been used with success on the flat lands of the James River. It costs $100.

Mr. *Carpenter*, of Caledonia, New-York, is also the inventor of a machine for reaping and thrashing grain: it is said to finish fifteen acres a day

Fig. 2.



with the help of one man to drive, and one man to tend the machine. Cost, $600.

Mr. *Esterly*, of Heart Prairie, Wisconsin, has recently patented a harvesting machine for reaping the heads of wheat, barley, rye, and timothy: it is warranted to cut twenty-five acres a day of wheat, and requires two men, a boy, and three horses. It is highly recommended by those who have seen it in action, and the State Agricultural Society, at their fair in 1844, awarded the inventor an extra premium for it. We believe this to be a machine of great promise.

REBATE. The groove sunk on the edge of any building material.

RECEPTACLE. In botany, has four different significations: 1. That part of a flower upon which the carpella are situated; or, in other words, the extremity of the fruit stalk. 2. The axis of the theca of *Trichomanes* and *Hymenophyllum*, among ferns. 3. That part of the ovarium from which the ovula arise, and which is commonly called the placenta. And, 4. That part of the axis of a plant which bears the flowers when it is depressed in its development; so that, instead of being elongated into a stem, it forms a flattened area, upon which the flowers are arranged, as in compositæ.

RECTIFICATION. A second distillation.

RECTRICES. The tail feathers of a bird.

RECTUM. The lowest intestine, ending in the anus.

RECUMBENT. Leaning down.

RED BAY. An indigenous Southern laurel, the *Laurus Carolinensis*: it is an evergreen of 10 to 25 feet.

REDDLE, or RUDDLE. A red aluminous marking stone.

RED GUM. A kind of blight which affects grain.

RED LIQUOR. Crude pyrolignate of alumina, used in dyeing as a mordant.

RED-LEAD. A mixture of the protoxide and peroxide of lead, used as a paint.

RED ROOT. A name given to

some dozen different plants with reddish-coloured roots.

RED SPIDER, PLANT MITE. *Acarius telarius*. A small red insect which spins a net, and lives on the juices of many plants and trees, attaching itself to the lower side of the leaf. It is especially injurious to hot-houses. They are destroyed by frequent syringing with cold water, by fumigations and washes of whale-oil soap and water.

RED TOP. A name sometimes given to *herd's grass*, and also to a dry perennial grass of the Middle States (*Tricuspis*) of little or no value.

RED WATER. A disease of cattle. See *Ox*.

RED WORM. An old name for the wire-worm.

REED. The genus *Arundo*, tall, aquatic, and boggy grasses. They may be destroyed by draining the soil, by liming and ashes. The soil is usually very fertile.

REED GRASS. Canary grass.

REFLECTION. The throwing back of the rays of heat or light by a polished surface or mirror.

REFLEXED. Bent back, turned back.

REFRACTION. The action exerted by water, glass, and all transparent bodies of changing the direction of rays of light, so as to make them appear bent.

REMIGES. The quill feathers of birds.

REMIPES. An order of coleopterous insects which are capable of swimming.

REMITTENT FEVERS. Fevers which are subject to periodical paroxysms, as the ague, bilious fever, &c.

RENAL. Relating to the kidneys.

RENIFORM. Kidney-shaped, of the shape of a kidney bean.

RENNET. See *Cheese*.

REPENT. Running on the ground.

REPTILIA. Cold-blooded vertebrate animals, as snakes, tortoises, frogs, lizards, &c.

RESIN. An inflammable product of the vegetable kingdom, rich in carbon and hydrogen, soluble in alcohol, but insoluble in water. There are a great number of species, some of which are evidently oxidyzed oils. They are used in varnishes.

RESERVOIR. A tank or artificial excavation to hold water.

RESOLUTION. In farriery, the discussion or dispersion of inflammatory gatherings or abscesses, by applying leeches and other means.

RESPIRATION. The act of breathing. It is accomplished by the movements of the diaphragm and muscles of the chest. Atmospheric air passing into the lungs is changed, oxygen being separated from it and absorbed into the blood, and four per cent. of carbonic acid thrown out. Water also passes off from the lungs. By these changes heat is produced. The effect of respiration is to alter the colour of the blood from black to bright red; it is at the commencement of life, and any interruption of the function is rapidly fatal.

REST HARROW. Ononis, a prickly shrub.

RETE MUCOSUM. The part of the skin immediately below the scarf-skin (epidermis).

RETIARIES. Spiders which spin webs.

RETICULATE. Like a net.

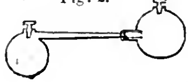
RETICULUM. The honey-comb bag of ruminants. See *Ox*.

RETINA. The nervous layer at the back of the eye which receives the images of things.

RETORT. A chemical vessel employed in a variety of distillations. It is generally made of glass or earthen-ware, and sometimes is provided with a stopper so placed above the bulb as to enable substances to be introduced into it without soiling the neck; in this case it is called a *tubulated* retort. A *receiver* is usually annexed to it for the purpose of collecting the products of distillation. *Fig.* 1 rep-

Fig. 1.

Fig. 2.



resents a plain retort and receiver; in *Fig.* 2, both are tubulated.—(*Brande.*)

REVERBERATORY FURNACE A furnace with an arched roof over the fire, so that the flame and heat may be reflected and a high temperature obtained.

REVOLUTE. Rolled backward.

RHAPONTICIN and RHEIN. Substances obtained from the roots of rhubarb.

RHEUMATISM. A nervous disease, sometimes attended with inflammation of the fibrous membranes and swelling of the joints.

RHIPIPTERANS. An order of insects, the *Strepsiptera.*

RHIZANTHS, RHIZANTHÆ. A small order of plants resembling fungi, but having sexes.

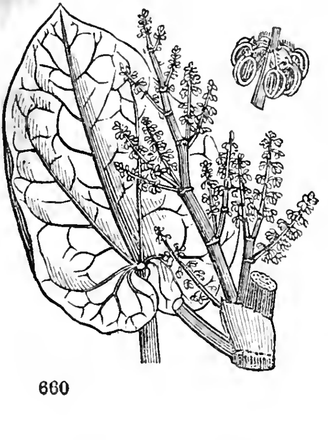
RHIZOMA. A root stock like that of the flag.

RHODIUM. A rare metal, of great hardness, found in some of the platina ores.

RHODODENDRON. A genus of handsome flowering shrubs; they are hardy, and prefer a peat soil.

RHUBARB. Plants of the genus *Rheum*, hardy, perennial, and large herbs of the same family as the *Docks.* The leaf stalks of several species, which grow two feet and more in length, are much used as a substitute for gooseberries; preserves are also made of them, and even a wine of

Fig. 1.



their juice, which is said to resemble the best gooseberry wine.

The edible kinds are Buck's new scarlet, of a deep red; the Tobolsk, which is the earliest; the Goliath and Admiral, of great size; Elfort, giant, Wilmot's early red; Myatt's Victoria, of the largest size; and the Australian, which is of the flavour of apples and yields stems nearly the whole summer. These are varieties of the *Rheum rhaponticum*, *undulatum*, and *Emodi* (*Australe*) (*Fig.* 1). They also yield medicinal rhubarb when the roots are allowed to remain from four to seven years. But the species which produces the best European rhubarb is the *R. palmatum* (*Fig.* 2).

Fig. 2.

The source of the Chinese drug is unknown.

Cultivation.—"The soil best suited to these plants is one that is light, rich, deep, and moderately moist. A poor, heavy, or shallow soil never produces them in perfection.

"It may be propagated by cuttings, but the mode almost universally practised is by seed. This should be sown soon after it is ripe, in September or October, for if kept out of the ground until the spring, it will often continue dormant for twelve months; if the danger of this, however, is risked, it must be inserted early in February or March. The seeds are best inserted in drills three feet apart, and an inch deep, the plants to remain where raised; for although they will bear removing, yet it always checks and somewhat lessens their growth. When they make their appearance in the spring, and have been thoroughly cleared of weeds, they may be thinned to six or eight inches asunder, and the surface of the ground about them loosened with the hoe. Towards the conclusion of summer, when it can be determined which are the strongest plants, they must be finally thinned to three or four feet, or the hybrid to six. They must be continually kept clear of weeds. In autumn, when the leaves decay, they are removed, and the bed being gently turned over, a little well-putrefied stable dung added, and some of the earth applied over the stools. In the spring, the bed may be again dug, previous to the plants making their appearance; and as the stalks, when blanched, are much less harsh in taste, require less sugar to be rendered palatable, and are greatly improved in appearance, at this period a trench may be dug between the rows, and the earth from it laid about a foot thick over the stool. This covering must be removed when the cutting ceases, and the plants allowed to grow at liberty. As the earth in wet seasons is apt to induce decay, the covering may be advantageously formed of coal ashes or drift sand, which are much less retentive of moisture. Those plants produce the seed in greatest perfection that are not gathered from, but on no account must they be subjected to the process of blanching."

The stems may be forced very readily by covering them with barrels or hand frames, and surrounding the outside by fermenting horse dung.

When the roots are wanted, the stalks should not be removed to any great extent; the soil is to be thoroughly loosened about the plants, once a year at least, by spading or trenching. They are taken up at six years, in the autumn, cleaned, scraped, and hung on strings to dry in the sun; a hole is often bored through the centre of the large roots for this purpose; the young roots are rejected. They are also dried, in part, by exposure to heat upon slabs of stone, and the large roots cut into slices. The process must be perfectly accomplished, and often requires several months; the loss by drying is four fifths of the weight.

RHUS. A genus of shrubs, some of which are of economical value, as the *R. coriaria*, which yields much tannin, and is used for dyeing and making leather; the *R. glabra*, which is a very common indigenous plant, is also useful in tanning; the poison oak (*R. toxicodendron*), poison sumach (*R. vernix*), poison vine (*R. radicans* and *R. pumila*), are all remarkable for their poisonous juice and exhalations. See *Poison Oak*.

RIBAND GRASS. Canary grass, and the striped leafed *Phalaris;* sown as an ornament in gardens.

RIB GRASS. A name for the plantain (*Plantago major*).

RIBS. The curved bones attached to the vertebræ behind; those which meet at the chest and are articulated to the sternum are called true ribs; those whose extremities are only furnished with cartilage are the false ribs. *In building*, curved timbers for roofing

RICE. Plants of the genus *Oryza*, especially the *O. sativa* (*Fig.*), or water rice, cultivated in South Carolina and other Southern and Southwestern States. In India and Africa several mountain or dry species are cultivated, as the *O. mutica*, but they are much smaller and yield less than the aquatic kinds. The cultivation in South Carolina is very successful on rich river bottoms, the yield being forty bushels or more the acre, and one hand managing five acres. The process is well described by a successful planter.

"Begin to plant about the 25th of March, trench shallow and wide, and scatter the seed in the row; make 72 or 75 rows in a task, and sow two bushels to an acre.

"Hoe about the end of April or beginning of May, when the rice is in the fourth leaf; then flood, and clear the field of trash. If the planting be late, and you are likely to be in grass, flood before hoeing; but hoeing first is preferable. The best depth to flood is three or four inches. It is a good mark to see the tops of the rice just out of the water; the deep places are not to be regarded: the rice will grow through in three or four days. Observe to make a notch on the frame of the trunk when the water is at a proper depth; if the rains raise the water above the notch, or it leaks out, add or let off accordingly. This is done by putting a small stick in the door of the trunk, about an inch in diameter: if scum or froth appear in eight or ten days, freshen the water, take off the trunk doors, run off the water with *one ebb*, and take in the next *flood;* then regulate as before. Keep the water on about fifteen or seventeen days, according to the state of the weather; that is, if a hot sun, fifteen days, if cool and cloudy, seventeen days, counting from the day the field is flooded; then leak off with a small stick for two days; then run off the whole, and keep the field dry. In four or five days after, hoe the second time, stir the ground, whether clean or not, and comb up the fallen rice with the fingers. Keep dry and hoe through the field. Hoe the third time and pick clean. This will be about the beginning of July. Then flood as you hoe. Let the water be the same depth as before. If any grass has escaped, it must be picked in the water after it shoots out. This is called the fourth hoeing, but the hoe is never used except for some high places, or to clean the dams. If the rice is flaggy and likely to lodge, flood deep to support it, and keep it on until fit to harvest."

Most of the rice exported is in the form of *paddy*, or cleaned; the hulling is readily accomplished by grain cleaners.

The Chemical Composition.—The grain of rice has been examined by Braconnot and others. It consists of 85·0 starch, 3·6 gluten, and 0·13 fat per cent. From this composition we are at no loss to account for its inferiority as an article of food; indeed, the parts removed by cleaning the chit or germ are much the richest portion. The ashes of the grain, chaff, and straw have been determined by Professor Shephard per cent.:

	The clean grain, ½ per cent. ash.	Chaff, 13·7 per cent. ash.	Straw, 12·4 per cent. ash.
Phosphate of lime	76·20	1·024	2·60
Phosphate of potash (nearly)	5·00	trace.	trace.
Silica (nearly)	20·00	97·55	84·75
Sulphate of potash	traces.	trace.	2·56
Chloride of potassium and loss	"	1·13	
Carbonate of lime	"	0·29	20·0
Carbonate of magnesia	"	——	——
Potash from the silicate	"	——	8·69

RICE WEEVIL. *Callandra oryzæ.* An insect very similar to the grain weevil, and which produces much destruction in crops of rice and wheat at the South: it is destroyed by kiln-drying the grain.

RICE, WILD, or WATER. *Zizanea aquatica, miliacea*, and *fluitans.* Indian rice. It grows in the margins of lakes and rivers. The *aquatica* is large and abundant in the Middle Western States, and was much used by the Indians and early French settlers, and called by them *Folle avoine.* The Indians collected the grain by first tying the fruit stems in bundles, and when they became dry, they passed through the plants in canoes, and, bending over the heads, beat the seeds from them into a blanket placed in their canoes.

RICINIC ACID. An oily acid, produced by distilling castor oil at a high temperature.

RICK. A stack.

RIDDLE. A coarse sieve to separate grain from dust, &c.

RIDGE. The upper timber in a roof, against which the rafters pitch.

RIDGING. Laying up the soil in narrow ridges.

RIDGLING. A male animal half castrated. They are troublesome, useless creatures.

RIGGIL. An imperfect sheep.

RIME. Frost.

RIMOSE. Resembling the broken appearance of the bark of old trees.

RING BONE. In farriery, a callus growing in the hollow circle of the little pastern of a horse, just above the coronet.

RINGING. An operation in horticulture; cutting out a ring of bark down to the new wood, but not into it, for the purpose of making a luxuriant branch fruitful. It arrests the descent of the elaborated sap, and swells out the flower buds. It is done in spring. When the wound is made into or through the new wood, the tree is killed, and this plan is pursued in forests to kill them preparatory to burning. Roots are also cut into or ringed for the purpose of throwing out new, healthy shoots. The width of the wound when fruit is wanted should not be great, and it is well to leave a part of the bark uncut, by which the place heals over more rapidly. Fruit has been doubled in size and much improved in flavour by this process.

RINGENT. Grinning. A name given to the personate corolla, as in the genus *Antirrhinum.*

RINGS, FAIRY. Rings of green grass, enclosing a less fertile spot: they are produced by the growth and decay of fungi, the green grass appearing where the fungi have just died.

RIPPLE GRASS. The smaller plantain.

RIPPLING FLAX. Separating the seeds by beating the plants against a board, or other contrivance.

RISTLE PLOUGH. A paring plough for cutting turfs and the roots of heath or other shrubs.

RIVOSE. A surface marked with irregular furrows.

ROADS. In the construction of good, durable roads, the following points are to be attended to:

"*Drainage.*—All exertion to construct or repair roads is considered unavailing until the bed of the road is freed from water, and secured against its return. Of what service can stone be when the road is immersed in water! To correct and prevent a recurrence of the evil, substantial ditches should be opened, so as to give a slope of one inch in twenty-four between the crowns of the road and bottoms. If open drains cannot be made on both sides, owing to the declivity of the surface, under drains should be constructed, with outlets, through the bed of the road to the lower side; and if springs exist in the site of the road, their water must be concentrated and conducted off by under drains. When a particular piece of road is observed to be continually heavy, and in a bad state, it is either caused by spring water, or is situated in a flat, from which the water cannot escape. These suggestion should not be lost to us. A principal defect in our roads is the want of efficient drainage. Wherever water is permitted to remain, either upon the surface or substratum, in wet seasons there will be a slough, and the bed of the road will be entirely broken up.

"*The substance or thickness of Materials.*—Without a sufficient depth of consolidated materials, there will not be a resistance equal to the weight which a highway is subject to. There must be weight to resist weight. If the weight of metal forming the substance be of an imperfect quality, more will be required than when sound and clean. In proportion to the quantity of deleterious matter contained in the body (as earth, small gravel, soft stone, &c.) must the thickness be increased. Any matter that is not of a sound nature has no power in road making, and therefore the hard materials alone contained in the roads can be calculated upon as possessing the quality to resist weights. Experience has taught that there can be no real security against a road giving way, taking the year through, unless 12 inches at least of good consolidated materials form the body of a road, and this upon a foundation rendered sound and dry by effectual drainage.

"*Sort of Materials.*—Not the *hardest*, but the *toughest* stones, are the best: the first will break, the latter bend. The trappean and basaltic rocks are therefore preferred; then whinstone, dark-coloured granite, and limestones.

"*Preparation and size of Materials.*—The stone to be employed is first freed from dirt, and then broken so small as to pass through the inch meshes of a wire sieve. Some allow the stones to retain the size of two inches, but none larger. The tougher the nature of the material, the smaller the size should be.

"*Quantity of Materials to be laid on at a Time.*—When a thick coat is laid on, the destruction of the material is very great before it becomes settled or incorporated with the road. The stones will not allow each other to lie quiet, but are continually elbowing one another, and driving their neighbours to the left and right, above and below. This wears off their angular points, produces mud and dirt, and reduces the stones to an angular form, and prevents their uniting and becoming firm. If there be substance enough already on the road, it will never be right to put on more than a stone's thickness at a time. A cubic yard, nicely prepared and broken, to a rod superficial, will be quite enough for a coat, and will be found to last as long as double the quantity put on unprepared and in thick layers. There is no grinding to pieces when thus applied; the angles are preserved, and the materials are out of sight and incorporated in a very little time. Each stone becomes fixed directly, and keeps its place, thereby escaping the wear and fretting which occur when they are applied in a thick stratum. On new roads, the covering should be applied in thin coats. As soon as one is imbedded, apply another, until the desired power is obtained.

"To say nothing of the saving in a course of years by the durability of a road formed under the new system, and which has been found in some cases, even where the traffic is considerable, by the side of a large town, to last for seven years without an additional stone being applied; to say nothing of the saving to the public in wear and tear of horses, carts, and tackle; to say nothing of the comfort of travelling a smooth road, and also to say nothing of employment found for the poor, yet a road can be maintained good and perfect for half the sum under the new system, which under the old is expended without improvement.

"*Spreading.*—Cause the load to be shot down a short distance from the place upon which you wish the materials to be finally spread, and direct the spreader to cast every shovelful from him equally all over the surface, and in such a manner as he would do if he were sowing wheat broad-cast. The road will then be not thicker in one place than another, and a section will be produced perfect and true.

"*Scraping.*—If it is desirable to keep a road dry at the foundation, it must be equally so at the surface."

ROARING. A disease in horses called broken wind. It is the result of injury to the cells of the lungs, brought on by too violent exercise, especially after meals.

ROCHAMBOLE. *Allium scorodoprasum.* "Spanish garlic. It has bulbs or cloves growing in a cluster, forming a kind of compound root. The stem bears many bulbs at its summit, which, as well as those of the root, are often preferred in cooking to garlic, being of much milder flavour. It is best propagated by the root bulbs, those of the stem being slower in production. The plantation may be made either in March or the early part of April, as well as throughout the autumn. They may be inserted either in drills or by the dibble, in rows six inches apart each way, and usually two inches within the ground, but thrive better if grown on the surface. A very small bed is sufficient for the supply of the largest family."

ROCHELLE SALT. Tartrate of soda and potassa ; used as a gentle purgative.

ROCK CRYSTAL. Transparent quartz.

ROCK SALT. The coarse native salt, found in immense masses in some parts of the globe. It consists of salt chiefly, but adulterated with chloride of calcium, gypsum, and marl.

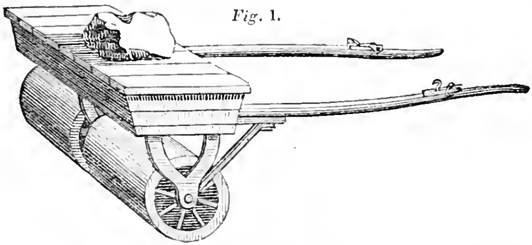
ROD. The same as a pole, 16½ feet. Four of these make Gunter's chain.

RODENTS, RODENTIA. Gnawing quadrupeds, with two long chisel teeth in the front of either jaw. Rats, rabbits, and squirrels are of this class.

ROE STONE. Oolite, rocks the structure of which is made of small rounded particles.

ROLLERS. Rounded logs, or cylinders of iron or stone turning on an axis, and capable of being drawn by hand or horses. They are of great service in levelling the surface of fields and breaking lumps. On loose soils they compress the earth and render it more fertile, and are much used to imbed small seeds and run over grass. The common roller is no more than a heavy log, but numerous varieties have been proposed. The improved kinds (see *Fig.* 1) are

Fig. 1.



constructed of iron, in two or more pieces, so as to run over two lands, the horse walking in the ditch, or central furrow. They also carry a wooden frame for rocks, so as to be weighted according to circumstances.

Instead of the frame for weights, or in addition to it, a box (*a*) is some-

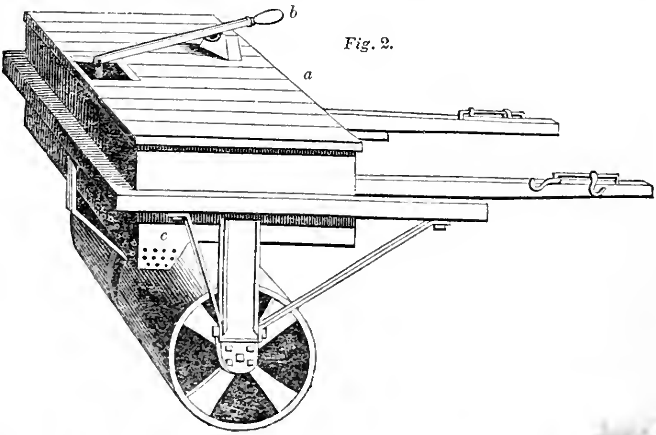
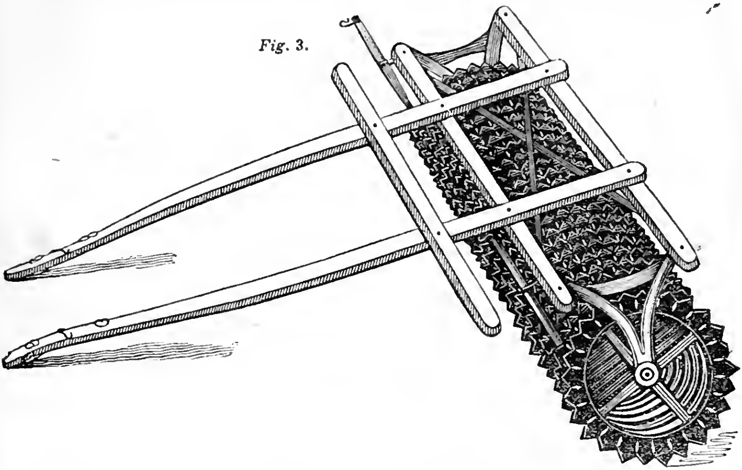


Fig. 2.

times attached, for the purpose of watering or sprinkling fluid manures over the young plants. As they are rolled, the man who leads the horse manages the watering by a string attached to the end of the lever (*b*), which, being raised, lets the fluid out through the small holes (*c*). The cylinder, or roller, is also set with scarifiers and other contrivances for cutting or crushing the soil, as in the clod crusher (*Fig.* 3) In some imple-

Fig. 3.



ments the roller is of a conical form, or of the figure of two cones, united at their bases for the purpose of running between furrows or ridges ; they are also made of a series of separate rings or wheels which run between drills (*drill rollers*), and may be used in marking the ground before sowing seeds.

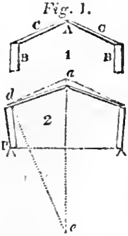
ROMAN VITRIOL. Blue vitriol, sulphate of copper.

ROOD. A square measure, equal to 40 perches or square poles. The fourth part of an acre.

ROOF. The covering of a building. The pitch, or inclination, should be much greater in northern positions than at the south, since snow and rains tend to rot the timbers more rapidly. Those which are covered with shingles must also be more pitched than those of slate or metal.

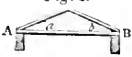
"A roof, as respects its construction, involves some knowledge of mathematics Of the general principles on which its proper construction depends, we shall here subjoin some account. The obvious mode of covering a building, where a greater or lesser inclination of the sides of the roof is required by the climate, is to place two sloping rafters, C C, upon the walls, B B, as in the subjoined diagram (*Fig.* 1), meeting at the apex, A, where we will suppose them so connected with a hinge as to be inseparable, but capable of descending by their gravity, as shown in No. 2. The walls are considered as solid masses, moveable on points, P. If the walls be not of sufficient weight, the thrust that will be thus exerted on them by the tendency of the rafters to spread at their feet will throw the walls out of an upright, as in No. 2, and the whole assemblage will be destroyed. By the laws of mechanics, it is known that the horizontal

Fig. 1.



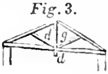
thrust thus acting on the walls is proportional to the length of a line, *d*, *c*, drawn at right angles to the rafter, intersecting a vertical line drawn from the apex, which it is manifest must increase as the roof becomes flatter. To counteract the thrust above mentioned, nothing more is necessary than to tie together the feet of the rafters, as in the following diagram (*Fig.* 2), in which A B is the tie in question, and thence is called a *tie-beam.* If the extent be not very great, the rafters may be kept from spreading by a minor tie, as at *a b*, called a *collar.*

Fig. 2.



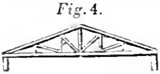
Beyond certain lengths or spans, however, it will occur to the reader that a tie-beam will itself have a tendency to bend, or sag, as the workmen call it, in the middle; and from this circumstance a fresh contrivance becomes necessary, which will be seen in the annexed diagram (*Fig.* 3), marked *c d*: this is called a *king-post*, or, more properly, *king-piece*, inasmuch as it does not perform the office of a post, but rather of a tie, for it ties up the beam to prevent its bending.

Fig. 3.



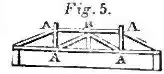
If the rafters be so long as to be liable to bend, two pieces, *a*, *a*, called *struts*, are introduced, which, having their footing against the sides of the king-post, act as posts to support or *strut up* the rafters at their weakest point The piece of framing thus contrived is altogether called a *truss.* It is obvious that by means of the upper joints of the struts we obtain more points of support (*Fig.* 4), or, rather, suspension; and that but for the compressibility of the timber, there would be no limit to the space which a roof might be made to cover.

Fig. 4.



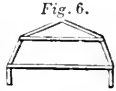
This compressibility takes place at those points where the fibres of the wood are pressed at right angles, or nearly so, with their direction; and many ways are adopted for avoiding this inconvenience. There is a species of roof, dependant in construction on the principles we have just described, which we shall here briefly notice, and whereof the following is a diagram (*Fig.* 5). This roof has three points of support, A, B, A; the posts A A, A A are called *queen-posts;* the collar, A B A, is here a *straining piece*, instead of a tie, as it was in the example of ties first noticed, its operation being exactly the reverse of a tie.

Fig. 5.



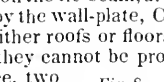
The *curb* or *mansard* roof is one in which a story is obtained, as may be seen in the annexed diagram (*Fig.* 6). Its principles are the same as those already mentioned, and do not here require farther notice.

Fig. 6.



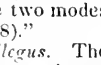
In the execution of roofs the expense of trussing every pair of rafters would be unnecessary, and the practice would also load the walls with a far greater weight than would be expedient; it is therefore the custom to place these *principal* parts of a roof at certain intervals, which, however, should never exceed ten feet. The rafters which are actually trussed are called *principal rafters;* and by the intervention of the *purline*, A, in the diagram (*Fig.* 7), are made to bear the smaller or common rafters, which are notched down on it.

Fig. 7.



These common rafters are received by, or pitch upon a plate, B, called a *pole-plate;* and the principal rafters, which fall on the tie-beam, are ultimately borne by the wall-plate, C. When beams in either roofs or floors are so long that they cannot be procured in one piece, two pieces, to form the required length, are *scarfed* together by indenting them at their joints, and bolting them together, of which practice two modes are here subjoined (*Fig.* 8)."

Fig. 8.



ROOK. *Corvus frugilegus.* The gregarious crow, almost domesticated in England in rookeries. They live, for the most part, on insects. The young are sometimes eaten.

ROOT. "That part of the central axis of a plant which is formed by the descending fibres, and whose function is to attract liquid food from the soil in which it is mingled. It differs from the stem in not having leaves or buds upon its surface, and in its tendency to burrow under ground, retreating from light; nevertheless, some kinds of roots are exclusively formed in air and light, as in the ivy, and other such plants."

Roots are of various figures, as fibrous; spindle, as in the radish; knotted, &c. The rhizome of the flag and the tuber of the potato are not roots, but subterranean stems. The cormus of palms and aroidæ is a mere expansion of tissue, which is neither a root nor stem.

ROOT CROPS. Crops of beets, turnips, carrots, &c.

ROOT STOCK. The rhizome of the flag, ginger, arrow-root.

ROSACEÆ. "A large and important natural order of plants, the species of which are, for the most part, inhabitants of the cooler parts of the world. They are in some cases trees, in others shrubs, and in a great number of instances herbaceous perennial plants: scarcely any are annuals. No natural orders contain more species of general interest, in the beauty of their flowers or their perfume: there is the rose itself, and various species of the genera *Rubus*, *Spiræa*, *Potentilla*, *Geum*, and *Pyrus*. The apple, pear, plum, cherry, peach, nectarine, apricot, raspberry, strawberry, and similar valuable fruits, are the produce of others. As medicinal plants, some are of considerable importance. Prussic acid is obtained from the leaves and seeds of the bitter almond, peach, plum, and other species. This important assemblage of plants is distinguished by having several petals; separate carpels; distinct, perigynous, numerous stamens; alternate leaves, and an exogenous mode of growth."

ROSE. The genus *Rosa*, which, by cultivation, has been extended to upward of a thousand varieties. They require a good loamy soil, and are much improved by judicious pruning. Many diseases infect the rose shrubs; of these, the *aphis* is the most common. They are also attacked with blight, and by the rose-bug, a coleopterous insect, of the family of the cockchaffers. But by proper cleaning, and syringing with water, or with tobacco water, the plants are easily preserved in health. Several varieties are worthy of cultivation for the perfume (*attar*) distilled from their petals. The French rose is used by druggists.

ROSEBAY. The handsome *Rhododendron maximum*.

ROSE BUG. Insects of the same family as the cockchaffer, infesting the rose, vine, and fruit-trees during June and July. The perfect insect issues from the earth in June, to which the female retires at the end of July and lays her eggs. They cannot be destroyed except by direct violence, fumigations and washes being of little service. The most usual means is to catch them by the hand, or by shaking the plants they infest, and burning or crushing them. The insects pass through all their transformations in one year in the soil, and emerge only in the beetle form.

ROSEMARY. *Rosmarinus officinalis*. A handsome evergreen shrub, cultivated for its odoriferous leaves, from which an essential oil is distilled. It requires a dry soil, and lasts many years.

ROSIN. The resin remaining after distilling the spirit from turpentine. Colophony.

ROSTELLUM. The name given to the retractile sucking tube of apterous insects.

ROT. A fatal disease of stock, especially *Sheep*, which see.

ROT IN WOOD. See *Dry Rot* and *Preservation of Timber*.

ROTATION OF CROPS. "As crops of the cultivated plants succeed to each other upon the same ground, a question to be determined is the order in which the different kinds should follow each other.

"All plants which are cultivated, and which are carried from the ground where they are produced, tend to render the soil less productive, or, in the language of farmers, to exhaust it.

"But plants which are suffered to decay, or which are consumed by animals on the ground on which they grow, do not exhaust the soil. On the contrary, the decay of the stems and leaves of such plants, either naturally or by the consuming of them by animals, tends to add those decomposing organic matters to the soil which form one of the elements of its fertility. This process may be imperceptible and slow, but it is that which Nature herself employs to form the soil, as distinguished from what has been termed the subsoil.

"Sometimes this process of decay is counteracted by the singular natural provision of a conversion of the decomposing vegetables into a substance which itself resists decomposition, peat. But with this exception, the tendency of the decay of vegetables upon the surface is to add to the fertile matters of the soil.

"This is well understood in the practice of agriculturists. When the productive powers of a soil have been exhausted by cultivation and the carrying away of its produce from the surface, it is laid down to herbage, in which state the future vegetation which it produces tends, by its decomposition upon the surface, to renovate the productive powers of the soil. Land in this state is said to rest.

"When land, however, has been impoverished by successive crops, and has become full of weeds, the laying it down to rest in that state is attended with less beneficial consequences than when the soil has been previously cleaned of injurious weeds, and fertilized by good culture. In the former case, the process of renovation is slow, if perceptible at all; the useless plants increase, and not those which are beneficial, and afford food to pasturing animals. Land, when properly laid down to grass, therefore, tends to recover its wasted powers of production. Land not properly laid down has less of this healing property, and may be more full of weeds, and no richer when ploughed up again after a time than when laid down. Under good management, however, the laying down of cultivated land to grass and other herbage plants to be consumed upon the ground, is a means of resting the soil and renovating its powers of production; and this mode of recruiting an exhausted soil being always at the command of the farmer, its application is important in practice. It is to be observed, also, that the poorer soils require this species of rest and renovation more than those which are naturally productive.

"The experience of husbandmen, from the earliest times, has shown that the same kinds of plants cannot be advantageously cultivated in continued succession. The same or similar species tend to grow feebly, or degenerate, or become more subject to diseases, when cultivated successively upon the same ground, and hence the rule which forms the basis of a system of regular alternation of crops is, that plants of the same or similar species shall not be cultivated in immediate succession; and farther, the same rule has been thus far extended, that the same species shall recur at as distant intervals of the course as circumstances will allow.

"All herbaceous plants, whose produce is carried off the ground which produces them, may be said to exhaust the soil upon which they grow. But all such plants do not exhaust the soil in the same degree; for after some species the soil is seen to be more impoverished than after others.

"And not only do different species of plants exhaust the soil in a greater or less degree than others, but the same species does so according to the different period of its growth at which the plant is removed from the ground.

"When an herbaceous plant is suffered to mature its seeds, it exhausts the soil more than when it is removed before its seeds are matured. All herbaceous plants, therefore, when cut in their green state, that is, before they have matured their seeds, exhaust the soil less than when they remain until they have ripened their seeds. Thus the turnip, when used in its green state, is one of the least exhausting in the agricultural class of plants to which it belongs; but the turnip, when allowed to remain upon the ground until it has ripened its seeds, is one of the most exhausting plants that is cultivated among us; and so it is with the rape and others.

"Farther, certain plants, by the larger or smaller quantity of manure which the consumption of them afford, are more or less useful in maintaining the fertility of the farm.

"When an herbaceous plant is suffered to mature its seeds, and when any part of these seeds is carried off the farm, the plant affords, when consumed by animals, a smaller return of manure to the farm than if the same plant had been cut down before it had matured its seeds, and been in that state consumed by animals. Thus it is with the turnip plant referred to. This plant is, with us, sown before midsummer. In the first season it forms a napiform root, and puts forth a large system of leaves. Early in the following season it puts forth a long stem, which bears flowers, and the seeds are generally matured about midsummer. If this plant is removed in the first stage of its growth, that is, after it has put forth its large leaves and formed its bulb, and is then consumed by animals, it returns a great quantity of manure; but if it remains until the second state of its growth, then the consumption of its stems and leaves return scarce any manure. The juices of the root have apparently been exhausted in affording nutrition to the flower stem, the flowers, and seeds.

"It is beyond a question, that, in order to bring a plant to its entire maturity by the perfecting of its seeds, a larger quantity of the nutritive matter of the soil is sucked up by it than when it is brought only to its less advanced stages. When crops of plants, therefore, are suffered to arrive at maturity, they are greatly more exhausters of the soil on which they grow than when they are cut down while they are green; and if those seeds are in whole or in part carried off the farm, the crops are exhausters of the farm, as well as of the ground which had produced them. Were the ripened seeds to be wholly returned to the soil, it may be believed that they might give back to it all the nutritive matter which had been derived from it. But, in practice, seeds are employed for many purposes, and are generally carried off the farm which produces them. When this is done in whole or in part, the plants produced are in an eminent degree exhausters of the farm, as well as of the soil on which they have grown.

"Farther, certain plants, from their mode of growth and cultivation, are more favourable to the growth of weeds than other plants. The cereal grasses, from growing closely together, and not admitting, or admitting partially, the eradication of weeds, are more favourable to the growth and multiplication of weeds than such plants as the turnip and the potato, which are grown at a considerable distance from each other and admit of tillage during their growth, and whose broad system of leaves tend to repress the growth of stranger plants.

"Having these principles in view, certain rules may be deduced from them for the order in which the crops of plants in cultivation in a country shall succeed to each other on the same ground.

"1*st*. Crops consisting of plants of the same or similar species shall not follow in succession, but shall return at as distant intervals as the case will allow.

"2*d*. Crops consisting of plants whose mode of growth or cultivation tends to the production of weeds, shall not follow in succession.

"3*d*. Crops whose culture admits of the destruction of weeds shall be cultivated when we cultivate plants which favour the production of weeds.

And farther, crops whose consumption returns to the soil a sufficient quantity of manure, shall be cultivated at intervals sufficient to maintain or increase the fertility of the farm.

"And, *4th*, when land is to be laid down to grass, this shall be done when the soil is fertile and clean.

"These rules may be applied to the plants which form the subject of common cultivation in the fields. In this country, the plants chiefly cultivated on the large scale are, the cereal grasses, chiefly for the farina of their seeds; certain leguminous plants, as the bean and the pea; plants cultivated for their fibres, as the flax and hemp; for their leaves, roots, and tubers, as the turnip, the cabbage, and the potato; and certain leguminous and other plants for forage or herbage. The plants of these different classes are yet to be described; and they are now only referred to with relation to the order in which they may succeed to each other in cultivation. The 1*st* class of these plants consist of the cereal grasses. These are chiefly wheat, Indian corn, barley, oats, and, partially, rye. All these plants are, in an eminent degree, exhausters of the farm. They are all suffered to mature their seeds, and are wholly or partially carried away from the farm. Farther, from the manner of their growth and mode of cultivation, they all tend to favour the production of weeds. For these reasons, and on the general principle that plants of the same or similar kinds should not follow in succession, the cereal grasses should not succeed each other, but should be preceded or followed by some crop which either exhausts the soil less, or admits of a more perfect eradication of weeds.

"*2d*. The leguminous plants cultivated for their seeds, as the bean and the pea, are all exhausters of the soil. They ripen their seeds, and the seeds are for the most part carried off the farm. Some physiologists suppose that they are less exhausters of the soil than the cereal grasses. But the essential difference between them, when considered with relation to their effect upon the soil, is that, from their growth and the manner of cultivating them, they are greatly less favourable to the production of weeds than cereal grasses. By their broader system of leaves, they tend to stifle the growth of weeds more than the cereal grasses; and, farther, they admit of tillage during a great part of their growth. This is especially the case with the bean [and maize], which is therefore regarded as a useful cleaning crop, and so is cultivated in rotation with the cereal grasses, as a means of preserving the land clean.

"*3d*. Hemp and flax, which are cultivated for their fibres. The exhaustion of hemp and flax is not great when they produce no seeds. All plants cultivated for their oils are exhausters of the soil. They are suffered to form and ripen their seeds, and their stems afford no return of manure to the farm.

"The next class of plants, from the large return of manures which the consumption of them affords, may be regarded as enriching or restorative crops, in contradistinction to the others, which may be termed exhausting crops:

"1. The turnip, the rape, and other plants of the cabbage genus, cultivated for their roots and leaves, and consumed upon the farm.

"2. The potato, the carrot, the parsnip, the beet, and other plants cultivated for their tubers and roots, and consumed upon the farm.

"3. The leguminous plants, the clover, the tare, the lucern, and others, when cut green for forage, and consumed upon the farm.

"The plants of the latter class, namely, the leguminous, when mixed with gramineous plants, as the rye grass, are commonly termed the artificial grasses, but would be more correctly termed the cultivated herbage or forage plants. They are often suffered partially to ripen their seeds, and are made into hay; and in this case they follow the general law, exhausting the soil more than when used green. And when the hay crop is carried away from the farm, they are to be regarded as exhausting rather than restorative crops.

"In speaking of these different classes of plants, the following terms may be employed:

"1. The cereal grasses may be termed corn crops.

"2. The leguminous plants cultivated for their seeds, pulse crops.

"3. The turnip, and other plants of the same kind, cultivated for their roots and leaves, may, with reference to their mode of consuming them, be termed green crops; or, with reference to the manner of preparing the ground for them, fallow crops.

"4. The potato, and plants of other families cultivated for their roots and tubers, may, in like manner, be termed green or fallow crops.

"5. The leguminous plants cultivated for green food, as the lucern and tare, may be termed green forage crops.

"And, lastly, the mixture of gramineous and leguminous plants cultivated for herbage or green feed may, in compliance with common language, be still termed the sowed or artificial grasses.

"Farther, distinguishing these different classes of crops according to their effects upon the fertility of the farm, they might be divided thus:

"1. Corn crops—exhausting crops, and favourers of weeds.

"2. Pulse crops—exhausting or cleaning crops, or capable of being rendered so.

"3. Green or fallow crops—restorative and cleaning crops.

"4. Green forage crops—restorative, and sometimes cleaning crops.

"5. The sowed grasses—restorative crops.

"Knowing these the general characters of the cultivated plants, we have, in devising a rotation, to cause the restorative and cleaning crops so to alternate with the exhausting crops as that the land may be preserved fertile and clean. Farther, when we find that land cannot be sufficiently cleaned by means of cleaning crops, we must make use of the summer fallow; and again, when we find that land requires rest, we may lay it down to grass for a longer or shorter time, taking care, when this is done, that the land shall be in as fertile a state as circumstances will allow, and free from weeds."—(*Low.*)

There are not many established rotations in the United States. The following is one which is found successful in Pennsylvania. It is, however, adapted only to strong, new soils. The manure should be added to the Indian corn:

	Field No. 1.	Field No. 2.	Field No. 3.	Field No. 4.	Field No. 5.	Field No. 6.	Field No. 7.	Field No. 8.
1st Year . .	Wheat	Rye	Wheat	Clover	Corn	Wheat	Clover	Oats
2d " . .	Rye	Clover	Corn	Wheat	Oats	Clover	Wheat	Wheat
3d " . .	Clover	Wheat	Oats	Rye	Wheat	Wheat	Corn	Clover
4th " . .	Wheat	Corn	Wheat	Clover	Clover	Rye	Oats	Wheat
5th " . .	Corn	Oats	Clover	Wheat	Wheat	Clover	Wheat	Rye
6th " . .	Oats	Wheat	Wheat	Corn	Rye	Wheat	Clover	Clover
7th " . .	Wheat	Clover	Rye	Oats	Clover	Corn	Wheat	Wheat
8th " . .	Clover	Wheat	Clover	Wheat	Wheat	Oats	Rye	Corn

It is very defective, as there are neither roots nor pulse crops; potatoes or roots might be introduced in part, after the leys, which may be of grass; and beans or pease can come after wheat, with the manure, or succeed the Indian corn.

Where a particular staple is cultivated, as tobacco, hemp, sugar, or cotton, it is to be introduced in its place according as it is a grain or green crop. Thus, in the above table, cotton or hemp, cultivated for seeds, may come in the place of wheat, and tobacco after manure.

Near cities, where there is a demand for everything raised, the rotation becomes much more manageable, and may be made to approach the very complicated formulas given in Europe, of which the one on the next page is a good specimen.

The chemical principles of rotations are under discussion, and cannot, therefore, be entered upon in a practical work. It may, however, be

MR. THOMAS BLACKIE'S SCHEME OF ROTATION UPON A FARM OF ONE HUNDRED ACRES, AS PROPOSED TO THE FRENCH GOVERNMENT.

Year	Acres	Crop
1st Year	30	Wheat
	15	Clover
	5	Turnips
	5	Cabbages
	2½	Beet
	2½	Carrots
	10	Oats
	5	Barley
	10	Potatoes
	3	Vetches
	2	Beans
	10	Lucern
2d Year	5	Turnips
	5	Cabbages
	2½	Field beet
	2½	Carrots
	10	Potatoes
	3	Vetches
	2	Beans
	15	Wheat
	10	Oats
	5	Barley
	15	Clover
	15	Wheat
	10	Lucern
3d Year	10	Oats
	5	Barley
	15	Wheat
	10	Potatoes
	3	Vetches
	2	Beans
	15	Clover
	15	Wheat
	5	Turnips
	5	Cabbages
	2½	Beet
	2½	Carrot
	10	Lucern
4th Year	15	Clover
	5	Turnips
	5	Cabbages
	2½	Beet
	2½	Carrot
	30	Wheat
	10	Potatoes
	3	Vetches
	2	Beans
	10	Oats
	5	Barley
	10	Lucern
5th Year	15	Wheat
	10	Oats
	5	Barley
	5	Turnips
	5	Cabbages
	2½	Beet
	2½	Carrot
	10	Potatoes
	3	Vetches
	2	Beans
	15	Wheat
	15	Clover
	10	Lucern
6th Year	10	Potatoes
	3	Vetches
	2	Beans
	15	Clover
	10	Oats
	5	Barley
	15	Wheat
	5	Turnips
	5	Cabbages
	2½	Beet
	2½	Carrots
	15	Wheat
	10	Lucern
7th Year	30	Wheat
	15	Clover
	10	Oats
	5	Barley
	5	Turnips
	5	Cabbages
	2½	Beet
	2½	Carrots
	10	Lucern*

briefly stated that leguminous crops are regarded as lime crops; the corn crops as potash and bone-earth crops, and most roots and green crops as potash crops; and that these should severally succeed each other in a well-tilled and prepared soil.

* To be ploughed up after seven years, and followed by wheat.

Boussingault, who has taken another view of rotations, and maintains that they should be so directed as to economize the nitrogen or ammonia of manures, has entered into an extensive series of researches to determine the best rotations. He analyzed his crops and manures, and calculated the amount of each component they carried from the field. As the rotations are good, we have no hesitation in presenting them, with his results.

"The measure of dung in use at Bechelbronn is the wagon drawn by four horses. After repeated weighings, it was found that this measure contains nearly 1 ton, 15 cwt., 2 qrs., 23 lbs. of moist material, or 7 cwt., 1 qr., 15 lbs., if that be computed dry. The first course of the rotation receives 27 loads of this manure, weighing about 48 tons, 14 qrs., 5 lbs., equivalent to 9 tons, 19 cwt., 0 qr., 2 lbs. of dry manure per hectare, or 20 tons per acre.

"The preceding analyses show that this charge of manure, which is to fertilize the soil during the course of the rotation (five years), contains,

Carbon	8,027 lbs.
Hydrogen	925
Oxygen	5,767
Azote	447
Salts and earth	7,188
	22,355

"Such are the principles which, together, form the organic matter that is to be consumed, and, in a major part, assimilated by the crops grown. I say partly, because I do not believe that the whole organic matter necessarily enters into the constitution of the plants which spring up during the rotation; no doubt a considerable portion of the manure is lost through spontaneous decomposition, or is carried away by the rain; and another portion may remain a long time dormant in the soil, to act as a fertilizer at a more or less distant period; just as, in the present rotation, the manure formerly introduced co-operates with that recently added. One thing is certain, viz., that the proportion of manure indicated is essential for average crops; by diminishing it, the produce is necessarily lessened. Lastly, it is proved that after the rotation the crops have consumed the manure, and the earth will not yield its increase unless a fresh quantity be added.

"I now proceed to consider the relation subsisting between the quantity of organic matter buried in the soil as manure and what is recovered in the crops. In this way the respective proportions of elementary matter which various crops derived from the air and the soil may be determined approximately, and a knowledge obtained of those rotations which least exhaust the land, or, in other words, which obtain from the atmosphere the largest amount of organic matter.

"The rotations set down in tables Nos. 1 and 2 are those adopted at Bechelbronn and throughout the greater part of Alsace. These two rotations, which differ only in the hoed crop introduced, potatoes in one, beet root in the other, are almost identical, nearly the same quantity of dry matter being produced per acre, and nearly the same quantity of organic material withdrawn from the atmosphere.

"The rotation No. 3 was introduced by Schwertz, at Hohenheim; theoretically, it is one of the most advantageous; it was tried at Bechelbronn, but abandoned, because pease and vetches fail frequently.

"Table No. 4 shows the triennial rotation with manured fallow; this is disadvantageous in point of theory. The organic constituents of the crop exceed but little those of the manure. Supposing that even the whole of the straw were converted into manure, the farmer would still be compelled to procure manure from abroad, in compensation for the outgoing of wheat. It is thus obvious why triennial rotation always requires a great deal of meadow land.

"In table No. 5 the result of the continuous cultivation of Jerusalem artichokes is given. At Bechelbronn these are dressed every two years with about ten loads of dung per acre. Upon an average, 20 tons of tubers and about two tons of woody stems are gathered in the course of two years. It will be perceived, from perusal of this table, that the culture of Jerusalem artichokes presents, theoretically, considerable advantages. The organic matter of the crop greatly exceeds that of the manure. Moreover, in Alsace, where it is very common, it is held to be most productive. Still, the organic matter of the stems must be taken into account, which, practically speaking, are nearly worthless.

"Table No. 6 comprises the data relative to a quadrennial rotation adopted by M. Crud, and in which are grown successively, 1st. Potatoes or beet root. 2d. Wheat. 3d. Red clover. 4th. Wheat. The first sowing is dressed with about 18 tons of half-wasted farm-yard dung. The gain in organic matter obtained by this rotation surpasses that of the preceding; but as the clover crops are not very sure when repeated every four years, M. Crud, for reasons which may be called in question, follows this rotation with one of lucern, which gets a fresh supply of manure. It cannot be denied that lucern furnishes a great mass of fodder, and in this respect the fertility of the land ought to be vastly enhanced, were this consumed on the spot; but I can discover no objection to the renewal of clover, if the lucern succeeds so well as M. Crud says it does. From too frequent repetition, farmers have gone into the opposite extreme of cultivating clover only every five or six years. This subject offers an important field for research. It is not impossible that the ill success depends often on premature mowing of the clover during the first year, and before its roots have acquired sufficient vigour. This practice has been abandoned with us for some years, and there is now everything to assure us that the second year's crop is thereby secured.

ROTATION, COURSE NO. 1.

Years.	Substances.	Crops per acre.	Crops dry.	Carbon.	Hydrogen.	Oxygen.	Azote.	Salts and earths.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1st	Potatoes	11733	2828	1244	161	1264	42	113
2d	Wheat	1231	1052	485	61	457	24	25
	Wheat straw	2798	2070	1002	110	805	8	145
3d	Clover hay	4675	3693	1750	185	1396	78	284
4th	Wheat	1521	1300	599	75	564	30	31
	Wheat straw	3456	2557	1237	135	995	10	179
	Turnips (2d crop)	8754	656	2832	36	278	11	50
5th	Oats	1232	975	494	62	358	21	39
	Oat straw	1650	1176	593	63	458	5	60
	Total	37050	16307	10236	891	6575	229	926
	Manure employed	——	9314	3426	391	2403	185	2999
	Difference	——	6993	6810	500	4172	44	2073

ROTATION, COURSE NO. 2.

Years.	Substances.	Crops per acre.	Crops dry.	Carbon.	Hydrogen.	Oxygen.	Azote.	Salts and earths.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1st	Mangel wurzel	2383	2907	1244	157	1262	49	182
2d	Wheat	1086	928	428	53	403	21	22
	Wheat straw	2468	1827	883	98	710	7	128
3d	Clover hay	11675	3693	1749	185	1396	77	284
4th	Wheat	1520	1300	599	75	564	30	31
	Wheat straw	3456	2557	1237	135	995	10	179
	Turnips	8754	655	281	36	277	11	50
5th	Oats	1232	975	495	62	358	21	39
	Oat straw	1650	1176	589	63	458	5	60
	Total	27224	16018	7505	864	6423	231	975
	Manure employed	——	9314	3426	391	2403	185	2999
	Difference	——	6704	4079	473	4020	46	2024

ROTATION, COURSE NO. 3.

Years.	Substances.	Crops per acre.	Crops dry.	Carbon.	Hydrogen.	Oxygen.	Azote.	Salts and earths.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1st	Potatoes	11733	2828	1244	164	1264	42	113
2d	Wheat	1231	1054	485	61	457	24	25
	Wheat straw	2798	2070	1002	110	805	8	145
3d	Clover hay	4675	3693	1750	185	1396	78	284
4th	Wheat	1515	1300	599	75	564	30	31
	Wheat straw	3456	2558	1238	135	995	10	179
	Turnips	8754	656	282	36	278	11	50
5th	Pease (dunged)	1001	915	425	56	366	38	28
	Pea straw	2558	2256	1033	112	803	52	255
6th	Rye	1539	1278	590	71	565	22	30
	Rye straw	3420	2780	1387	155	1129	8	100
	Total	148280	21388	10035	1160	8622	323	1210
	Manure employed	——	11176	4000	470	2883	223	3599
	Difference	——	10212	6035	690	5739	100	2359

ROTATION, COURSE NO. 4.

Years.	Substances.	Crops per acre.	Crops dry.	Carbon.	Hydrogen.	Oxygen.	Azote.	Salts and earths.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1st	Dunged fallow	——	——	——	——	——	——	——
2d & 3d	Wheat	3041	2600	951	150	1128	60	62
	Straw	6875	5080	2462	270	1979	20	356
	Total	9916	7680	3413	420	3107	80	418
	Manure employed	——	3795	1358	159	979	76	1222
	Difference	——	3885	2055	261	2128	4	804

NO. 5, CONTINUOUS JERUSALEM ARTICHOKE CROPS.

Years.	Substances.	Crops per acre.	Crops dry.	Carbon.	Hydrogen.	Oxygen.	Azote.	Salts and earths.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1st & 2d	Artichokes	48473	10083	4366	585	4366	161	605
	Stalks	25850	22497	10289	1215	10289	90	630
	Total	74323	32580	14655	1800	14655	251	1235
	Manure employed	——	8624	3087	362	2225	172	2777
	Difference	——	23956	11568	1438	12430	79	1542

NO. 6, QUATRENNIAL ROTATION ADOPTED BY M. CRUD.

Years.	Crops grown.	Crops per acre.	Crops dry.	Elementary ingredients of the crop. Carbon.	Hydrogen.	Oxygen.	Azote.	Salts and earths.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs
1st	Half acre of potatoes	9167	2209	972	128	987	33	88
	Ditto of beet roots	18333	2237	957	130	970	38	141
2d & 4th	Wheat, 153 bushels	3331	2847	1312	165	1235	65	68
	Wheat straw	7333	5243	2537	278	2040	21	347
3d	Clover, three cuttings	7333	5793	2746	290	2190	121	446
	Total	45497	18329	8524	991	7422	278	1110
	Manure consumed	——	8349	2989	350	2154	167	2688
	Difference	——	9980	5535	641	5268	111	1578

SUMMARY.

Rotations.	Dry manure expended upon one acre in one year.	Azote contained in the manure.	Dry produce obtained in one year upon one acre.	Azote contained in the produce.	Gain in organic matter in one year upon one acre.	Gain in azote in one year upon one acre.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
No. 1 .	1862	37	3261	46	1399	9
No. 2 .	1862	37	3204	46	1342	9
No. 3 .	1862	37	3564	54	1702	17
No. 4 .	1265	25	2561	26	1295	1
No. 5 .	4312	86	16290	125	11975	39
No. 6 .	2087	42	4582	70	2495	28

"From all that precedes, it is obvious that rotations which include trefoils, red clover, lucern, and sainfoin are those that afford considerably the largest proportion of organic matter; a fact, indeed, which, if not legitimately established, has still been long acted on in that system of cropping which embraces forage plants as an element. Lucerns, too, when they have taken kindly, yield an extraordinary quantity of forage, as every one may see by turning to the produce of the piece under that crop which, in the system of M. Crud, succeeds the quatrennial rotation. At the end of his rotation, M. Crud always lays on manure in the ratio of 18 tons per acre, which lasts for six years, and may be said to suffice for the succession of crops in the appended table:

Crops.		Produce per acre.	Contents in azote.
Lucern, dry,	1st year .	3080 lbs.	72 lbs.
"	2d year .	9240	215
"	3d year .	11458	269
"	4th year .	9240	213
"	5th year .	7333	172
Wheat,	6th year .	1448	28
Straw		3645	11
			980
Dung employed . .		40233	205
Total gain in azote			775
Gain in azote per annum and per acre			130

"In glancing at these tables, it is obvious that the azote of the crop always exceeds the azote of the manure. Generally speaking, I admit that this excess of azote is derived from the atmosphere; but I do not pretend to say in what precise manner the assimilation takes place. I shall only quote the conclusion of a paper which I published on the subject in the year 1837. Azote may enter immediately into the constitution of vegetables, provided their green parts have the power of fixing it; azote may also enter vegetables dissolved in the water which bathes their roots, and which always contains it in a certain proportion. Lastly, it is possible that the air may contain an infinitely minute quantity of ammoniacal vapour, as some natural philosophers have maintained, and that this, assimilated, decomposed, and recomposed anew by the plant, is the source of its azotized constituents."

ROTTEN STONE. A soft aluminous mineral used in polishing metals.

ROUP. A disease of *Poultry*, which see.

ROWAN-TREE. The mountain ash (*Pyrus aucuparia*).

ROWEL. A seton; also the sharp wheel of a spur.

ROWEN. A name for after-math hay.

RUBEFACIENTS. Substances which produce redness on the skin without blistering.

RUBBLE-STONES. Fragments of brickbats, loose stones.

RUBBING-POST. A useful appendage to the cattle-yard.

RUBIGO. Rust in plants. See *Uredo.*

RUDDLE. An ochreous clay, reddle.

RUE. *Ruta graveolens.* A fœtid shrub; the leaves are reputed of use as an antispasmodic. It grows readily in a clay soil without manure, and is propagated by slips.

RUMEN. The paunch, or first stomach, of ruminating quadrupeds.

RUMINANTS. Animals, as the ox, sheep, and deer, which have four stomachs and cloven hoof, and chew the cud.

RUMINATION. The act of *Chewing the Cud*, which see.

RUNCINATE. In botany, hooked back, or curved in a direction from the apex to the base, as the lobes of the leaf of the dandelion.

RUNNER. The *stolon*, or running stem, as in the strawberry: it is a convenient means of propagation.

RUNT. A variety of common pigeon; small black cattle of Wales and Scotland; decrepid pigs.

RUPTURE. A hernia or sinking of the bowels through, so as to form a large, soft tumour.

RURAL ECONOMY. The management of all things pertaining to the farm.

RUSHES. The family of sedges, called by botanists *Juncus* and *Scirpus*, growing in rich wet lands: they are destroyed by draining, tillage, and liming. Rushes make excellent mats, coarse basket-work, and bottoms of chairs.

RUST. Peroxide of iron, with some amount of carbonate. A family of parasitic fungi infesting grain and plants, sometimes called *Rubigo.* See *Uredo.*

RUSTIC-WORK. In building, a term applied to work jagged out into an irregular surface. Work, also, which is left rough.

RUT. To cut a line on the soil with a spade. The copulation of deer in the rutting season; the track of a cart-wheel.

RUTA BAGA. See *Turnip.*

RYE. *Secale cereale*, of the family *Gramineæ.* "It bears naked seeds on a flat ear furnished with awns like barley. The straw is solid, the internal part being filled with a pith, which, if it causes it to be inferior as fodder, makes it more valuable for litter, and still more so for thatching. The value of the straw is often nearly equal to that of the grain. Rye grows on poor, light soils which are altogether unfit for wheat, and hence tracts of light sands are often denominated rye land. On these soils this grain is far more profitable than wheat, which can only be raised there at a great expense of marling and manuring. From experiments made to ascertain the quantities of nutritious matter in rye and wheat, Thaer states their real comparative value to be as 64 to 71. If the soil is capable of bearing a moderate crop of wheat, it would be much more advantageous to sow one portion of a field with rye and another with wheat; and if meslin bread is desired, the two grains may be mixed in any required proportion. Excellent bread is made of two parts of wheat and one of rye, ground together. Rye is at present raised in very small quantities in the United States.

"Rye is extensively cultivated in Europe, especially in the Netherlands, where it is the chief grain from which the spirit called Hollands is distilled; and it is also the source of whiskey. When malted, it makes excellent beer, one bushel of rye malt being equal to at least one and a quarter of barley malt. The cultivation of rye is very simple; it is usually sown after wheat, where the soil is light and rich, or after turnips and potatoes, in those soils which are not strong enough for wheat.

"It is mostly sown as a green crop, and when fed off early in spring with sheep, the land is invigorated, and will bear excellent potatoes or other roots the same year. This practice cannot be sufficiently recommended; and if the rye is sown very early in autumn, it may be fed off in October and November, when sheep feed is beginning to fail, without any detriment to the succeeding spring produce.

"Winter barley and winter oats have been substituted for rye as spring fodders by some farmers; but on land of moderate quality rye is generally preferred. It bears the severest winters, which is not the case with barley or oats. The rye which has been fed off very early may be allowed to remain for seed, which it will produce more or less abundantly, according as it has been fed off earlier or later.

"The preparation of the land for rye is the same as for wheat, except that in very light soils no more ploughings are required than will clear the ground of weeds. If rye is sown after harvest, one ploughing only is usually given. It will thrive upon rich wheat soils, as well as upon lighter, and, as it throws out numerous stems in rich land, it is the more profitable as fodder, although the crop of grain might not be so abundant when the plants are too much crowded. To have as much green food as possible, the rye is always sown broad-cast, three bushels at least to an acre; some sow a sack, and with advantage.

"There is a variety of rye mentioned by continental authors by the name of *Seigle de la St. Jean*, or St. John's-day rye, because it grows so rapidly that, if sown about St. John's day (24th of June), it will be fit to mow green by the middle of September, and in favourable seasons may be fed off again in November, without preventing its giving ample feed in spring, and a good crop of grain at the next harvest. It might be advantageous to introduce this variety. There is no doubt that there are varieties of the same kind of plants which have a much more vigorous vegetation than those commonly cultivated, and the introduction of them where they are not known is an important benefit to agriculture. The celebrated agriculturist Du Hamel du Monceau mentions an individual who had obtained, from one sowing, five abundant cuts of green rye for cattle in two years. If any green plant is cut down before the fructification is completed, it will, in general, throw out fresh stems; and in very rich soils its blossoming may thus be continually retarded until the roots become too weak to force successive stems.

"Although the value of rye as a green crop is fully admitted, very little is grown for food; yet on some poor soils, where wheat and barley are now often sown with a very poor return, and at a great expense of manure, rye and buckwheat would give a much greater clear profit, and would require much less manuring: and where there are not ready means of improving the soil by claying or marling, the cultivation of rye would be found most advantageous; and, by means of sheep, very poor sandy soils might thus be made profitable. The grains of rye from the distilleries are excellent food for milch cows and hogs, which fatten readily on them.

"Rye is subject to most of the diseases which attack the plants of the family of the *Gramineæ*, such as rust, mildew, burned ear, and smut-ball. But there is one remarkable disease, which, although it is sometimes found in wheat, is much more commonly observed in rye. It is called the ergot, the French name of a cock's spur, which the diseased grain resembles in shape. By some perversion of the vital functions of the plant, the embryo, or germen, instead of growing into a regular seed filled with farina, shoots out a long black fungus-like substance, several times the length of a common seed, which rises above the chaff, and has the appearance of a slender pyramid, slightly bent on one side. This substance is soft and easily broken or cut, and is uniform in its internal texture, without any husk or skin over it. If it were merely the loss of the grain of which the ergot takes the place, the mischief occasioned by this disease would be comparatively trifling; but this fungus, when taken internally, mixed with the rye flour converted into bread, has a most powerful and deleterious effect on the animal frame. When taken in any considerable quantity, it produces the most dreadful diseases. This was first observed in France, where a great scarcity from the failure of the crops, accompanied with a more than usual production of the ergot in rye, obliged the poorer inhabitants of certain districts to make bread from diseased rye. The consequences were horrid to behold; their limbs rotted and separated from the trunk before death relieved them from their misery. The ignorant ascribed it to witchcraft, but experiments made on animals by feeding them on ergotted rye soon showed the real cause.

"The extraordinary effects of the ergot of rye have made it the subject of experiments in medicine, and it has been found extremely useful in certain cases of protracted labour. It is consequently become an article of commerce as a drug."

RYE GRASS. See *Grasses*.

S.

SACCHARIC ACID. An uncrystallizable acid, produced by the action of nitric acid on sugar. Its salts are called saccharates.

SACCHAROMETER. An implement for taking the specific gravity of sirups and worts. Baumé's hydrometer is chiefly used.

SACCHAROULMIN and ULMIC ACID. A brown, brilliant substance obtained by digesting sugar for a long time in dilute nitric or sulphuric acid.

SACCHOLACTIC ACID. Mucic acid, obtained by treating sugar of milk with nitric acid.

SACK. A coarse, large bag; a measure of three bushels.

SAC OF THE EMBRYO. In botany, the small enclosed body in which the embryo is placed during its growth.

SACRUM. The lowest portion of the spine.

SAFFLOWER. The *Carthamus tinctorius*, bastard saffron. An annual of the family *Compositæ*, the flowers of which yield a rich red colour when treated with solution of carbonate of soda. Rouge is made from them. There is no difficulty in their cultivation.

SAFFRON. *Crocus sativus*. A bulbous plant with purple flowers, the stamens of which yield a bright yellow colour to hot water. They are used in medicine, but are of no importance. The cultivation presents no difficulties. The stamens, or internal, thread-like parts of the flower, are to be collected when of the brightest colour, and dried loosely without compression. The bulbs are placed in a fair soil six inches apart, in June, and the flowers gathered in September, the stigmas being plucked out and dried in a warm room. The first year the yield does not exceed three pounds, but in the second and third twenty-four are obtained. The bulbs are taken up and divided the third year.

SAFFRON, MEADOW. Colchicum.

SAGAPENUM. A fœtid gum resin from a species of ferula.

SAGE. *Salvia officinalis*. A well-known aromatic perennial. The soil should be dry, and tolerably rich. It is propagated by splitting the roots, or by root shoots.

SAGITTATE. Shaped like an arrow head.

SAGO. A starchy farina from the pith of several palm-trees, as the *Sagus farinifera*, *Rhumphii*, &c. It is a good, wholesome food, and much esteemed for puddings and gruel. In England a gruel of sago is often given to horses after a hard run. The Florida arrow-root is a kind of sago obtained from the pith of the *Zamia integrifolia* and *pumila*, indigenous plants.

SAINFOIN. *Hedysarum onobrichis* (*Fig.*), *esparcette*. A long-rooted, perennial, leguminous plant with red flowers. It is native in calcareous soils.

"There are few plants which have

more rapidly improved the value of poor, thin, calcareous soils than sain-

foin; and in the richer kinds of loam, which contain a considerable proportion of calcareous matter, its value surpasses even that of broad clover, giving fully as great a return, with a much smaller expenditure of manure. The plant has a strong, woody, and fibrous root, which insinuates itself into the fissures of calcareous rocks, and finds moisture in the dryest seasons, while its spreading fibres keep the earth from being washed down the steep slopes of the hills. In favourable situations, it may be made into hay twice in the year, or cut oftener as green food. In the most arid and exposed situations it gives at least one good crop of hay. The plant grows about two feet high, and the stem branches out into many compound leaves. After it has been mown, it shoots out rapidly again, and may be advantageously depastured by every kind of cattle or sheep. There are varieties of the plant which differ in the rapidity of their growth: the best is called, in France, *esparcette*, or *sainfoin à deux coupes*. From France it has been introduced into England. The duration of sainfoin depends on the nature of the soil, and the state it was in with respect to weeds when it was sown. A cold, wet subsoil soon destroys the roots, whereas a free and dry one, whether rocky or gravelly, gives them vigour. Grass and weeds, which choke the crown of the plant, soon cause it to decay, as is the case with lucern. With every advantage, it may last in vigour ten years, especially if it is occasionally invigorated with a top-dressing of manure or ashes, or, which is best of all, with diluted urine, or the drainings from dunghills. During that time it may be cut twice for hay every year, taking care to cut it before the flower is faded or the seed formed; and if sheep are folded on it after the second cutting, the next crop will well repay the trouble. It is usually sown in spring in a crop of barley or oats, which should be sown thin in order that the sainfoin may not be smothered. The land should have been prepared by a cleansing crop. From three to four bushels of seed may be sown, harrowed in, and rolled. It is not often drilled, although this method, by allowing the use of the hoe between the rows, would much strengthen the young plants, and protect them against coarse grasses, which are their greatest enemies. In the first year the sainfoin should not be fed off by sheep; and if it is mown, it should not be mown too close to the ground. The crown of the root in the young plant rises a little above the ground, and if this be bit off, or cut with the scythe, the plant dies. It is useful to harrow the ground lightly, to draw the earth round the roots, and to destroy seed weeds soon after the barley or oats are reaped. The sainfoin does not produce a large crop the first year, for some of the seeds will lie a twelvemonth in the ground before they spring up. It is in perfection after the second year, when a portion may be reserved for seed. Sainfoin hay is extremely nourishing for every kind of cattle, especially if it has been made without rain. Although it is not apt to heat in the stack, it must be put up in a very dry state; and if it has suffered from rain, too much care cannot be taken thoroughly to dry it; for the water insinuates itself by capillary attraction into the hollow stems, and is long in evaporating, so that when it feels quite dry it may yet contain much water. The mode of discovering this is to twist it strongly in the hands into a rope, when the moisture, if there is any, will ooze out. It is better to let it dry thoroughly, than, by carrying it in a hurry, to run the risk of its becoming mouldy within. In very precarious seasons it may be carried in a green state, provided there be no moisture in it from dews or showers, and stacked in alternate layers with good straw. It will impart some of its fragrance to the straw, and lose none of its nutritive qualities. The same may be done with lucern or clover. The most advantageous use of sainfoin, however, is to cut it green and give it immediately to the cattle. There is no danger of their being hoven by it, for it ferments very slowly, owing to the fibrous nature of the stem. If the situation of the field admits of occasional irrigation, without danger of the water stagnating, the produce of the sainfoin will be greatly increased; and it may then be cut four or even five times in a season without fear of exhausting its strength. When it begins to appear thin on the ground, and other plants seem to get the better of the sainfoin, it is time to break it up. The land will be found much improved in fertility by the sainfoin. A poor chalk or gravel, which before would scarcely repay the seed sown in it, will now, by the gradual decay of the roots and fibres of the sainfoin, produce several good crops without any other manure. The prudent farmer, however, will not entirely destroy, by repeated crops of grain, that cohesion of the soil which is produced by the roots of the sainfoin; but by a judicious course and proper application of the manure, which the sainfoin enabled him to make, he will keep up the newly-acquired fertility until, in the course of ten or twelve years, he can again sow sainfoin seed in it with the prospect of a crop more abundant than the first. Many a poor, barren tract of calcareous rock and gravel has been fertilized and raised in value by the sole effect of the sainfoin, without which it must have remained in its unproductive state.

"Although a chalky soil is best adapted to the growth of sainfoin, it may be sown with advantage in all light loams, provided the substratum be sound and dry. On very rich, deep moulds lucern is a more profitable crop; but sainfoin will thrive where lucern would fail; and it is particularly adapted for poor, dry soils.

"There is nothing peculiar in the manner in which sainfoin is made into hay. It should not be shaken about too much, for fear of injuring the flower and breaking off the leaves. The swarth should be merely turned over, when dry on one side, and then, as soon as it is dry through, it should be put into small cocks, occasionally spread out in the sun, when the dew is off the ground, and carried to the stack as soon as it is sufficiently made. It should take a good heat in order to make it compact, but without acquiring too dark a colour. Experience alone can teach the exact time when it should be stacked. When it is left for seed, it should be examined carefully after the blossom fades. The lower pods will be filled with ripe seed before the blossoms at the top of the spike of flowers are withered or the seed formed in them. If the sainfoin were left standing till these seeds were ripe, the lowest would be shed; but by cutting it at a proper time these may be preserved, while most of the latter will ripen in the straw sufficiently to vegetate when sown. Rainy weather is very injurious to the seed crop; a fine time should therefore be selected, if possible, even at the risk of a smaller crop. The seed is only gathered for sowing; but in case there should be more than is required for that purpose, and no ready sale, it is excellent food for horses. The produce varies from three to five or even six sacks per acre. It is easily thrashed out, and this operation is often done on a cloth in the field, when the weather permits. It is readily done by a thrashing machine, and winnowed like corn. On the whole, there are few plants the cultivation of which is so advantageous as that of samfoin on the soils on which it thrives best."

SAINT JOHN'S WORT. John's wort.

SALAL BERRY. A fruit from the Columbia, of a dark colour, sweet taste, and the size of a grape.

SAL AMMONIAC. Muriate of ammonia. A common salt of ammonia much used in the arts. It is very soluble in water, and has been used as a steep by Mr. Campbell; one pound, being added to one gallon and a half of water, is sufficient for one bushel of seed. A small amount of it exists in putrescent fluids. The expense of this preparation will probably hinder an extensive use.

SALEP. The farinaceous product of the roots of the *Orchis mascula*.

SALICIN. A neutral crystalline body existing in willow bark.

SALICYL. An hypothetical compound radical, $C_{14}\ H_5\ O_4$, existing in salicylous acid, &c., bodies derived from salicin.

SALIFEROUS. Containing salt; a name given to the new red sandstone formation.

SALIFIABLE BASE. A substance which combines with acids to form salts.

SALIVA. The spittle: it is prepared by the parotid and other glands, and mixed with the food during mastication: its office is important. According to Liebig, it is a means of introducing oxygen into the stomach to accomplish the first step in digestion. Its loss is always injurious to animals.

SALIVATION. An excessive discharge of saliva, slobbering; change of food, with salt, are preventives in cattle.

SALLOWS. Willows which grow in marshy lands, and produce tough, strong branches, are so called.

SALLOW THORN. *Hippophaë rhamnoides*. An ornamental shrub five feet in height.

SALSIFY. *Tragopogon porrifolius*. Vegetable oyster. A biennial composite plant, the root of which grows to the size of a small carrot, is white, and an excellent vegetable; the young spring shoots of the second year are also eaten as asparagus. Sow the seed in April or May, in drills, twelve inches apart, thin to six inches, and work when wanted; the roots are taken up before late frosts, and kept in a moist cellar. For seeds, set out some thrifty plants in spring, or some may be left in the ground.

SALSILLA. An herbaceous plant of Peru, of the genus *Alstrœmeria*, cultivated for its edible roots.

SALT, COMMON. Chloride of sodium. It requires three times its weight of water for solution, and is composed of one equivalent sodium (23·31) and one chlorine (35·47).

It is a substance of great importance in agriculture: in the pure state, as a means of preserving butter and meats, or supplying cattle with a wholesome and necessary food, and, in the impure state, as a manure and steep for seeds.

As a Steep.—A strong solution, or ordinary brine, is an admirable preparative for wheat, oats, and grains; it destroys the seeds of smut and other parasites, as well as the eggs of insects, and also enables us to separate the plump, heavy kernels from the light and motheaten. It has proved a certain remedy, even when the grain was known to be smutted.

In doses of fifteen to thirty bushels to the acre, it is used in Cheshire on a clean fallow to destroy insects in the ground, couch grass, and other noxious weeds; the land is left unsown for three to six months after; as a manuring, in quantities of three to five bushels, on wheat, oats, rye, potatoes, turnips, and other crops, it has often produced the best results. It is not indicated on those soils which are within reach of the sea air, as they receive a sufficiency.

Plants absorb weak solutions of salt, but are injured by a strong dose; they also possess the power of decomposing it, and appropriating its soda. There are failures when salt is used indiscriminately; but all the plants which require much soda, or alkali, and grow distant from the sea, are undoubtedly benefited thereby.

Salt is of great use in composts with lime, vegetable matter, and earth. If these be kept moist, but sheltered, there is gradually formed the carbonate of soda and chloride of calcium, both of which are excellent manures. The heap should be stirred often, and contain as much lime as salt, with a sufficient quantity of vegetable matter and earth to keep the whole moist. Or the heap, instead of containing salt, may be watered with salt water, or made up with sea-weeds or salt muck.

Salt, in small quantities, is also a desirable addition to the farm-yard manure, and all vegetable composts.

SALTING MACHINE. "The instrument resembles a common syringe of more than ordinary dimensions, and, although not quite so simple in its construction, it is intended to be used in the same way as the syringe, provided the point or tube be not exposed to the air. The advantages to be derived from the use of the instrument are explained by the fact that a joint of meat may, in the simplest manner, be properly salted in less than ten minutes. The brine is made of the usual ingredients, and after the salt and other substances are completely dissolved, the liquid is poured into the machine, and the nipple, or tube (the circumference of which is perforated with three small holes), is inserted into the most solid part of a joint of meat, and the contents are, by a very strong pressure, forced through the fibres until the brine is seen to escape on the surface. For this purpose, a smaller quantity of pickle is used than is employed in the ordinary method of curing meat, and the bone (if there be any) in the centre becomes thoroughly impregnated with the fluid. By the present mode of salting meat, it is a matter of some difficulty to inject the brine into the innermost part of a large joint, whereas by the process which is adopted in the use of the instrument, the size or substance of the meat presents no additional trouble to the operator."

SALT MARSHES. Marshes washed by sea water: the herbage is coarse, but often very nutritious, and preferred by cattle.

SALT OF LEMONS. Binoxalate of potash, used in removing iron mould from linen.

SALTPETRE. See *Nitre.*

SALT, SPIRIT OF. Muriatic acid.

SALTS. Chemical compounds, which are usually (oxysalts) formed of a base and acid, and possess neither acidity nor alkaline action. Haloid salts are those which are binary, containing a metal in combination with an electro-negative element.

SALTWORT. The genus *Salicornia*, which grows on salt marshes: the ashes yield barilla.

SALVE. An ointment.

SALVER-SHAPED. Hypocrateriform. A monopetalous corolla, with a long tube and spreading limb at the top.

SALVING SHEEP. Anointing them with a mixture of tar and butter or lard. See *Sheep.*

SAL VOLATILE. Sesquicarbonate of ammonia, or smelling salts.

SAMARA. An indehiscent, few-celled seed, with an expansion of tissue resembling wings, as the pods of the ash and alanthus.

SAND. Divided silicious matter: it is extremely permeable to water, retains heat well, but is infertile. Sand is much used to improve the texture of stiff clays, but vegetable matter does this better, while it enriches the soil.

SANDAL WOOD. *Pterocarpus santalinus.* Red saunders, a dye wood, but giving fugitive reds.

SAND BATH. A quantity of sand heated by a flue, and used in the laboratory.

SAND CRACKS. Fissures in the hoofs of horses, from which matter exudes; it is customary to fire the edges of the wound, dress with hot pitch, and bandage. They produce much lameness.

SANDSTONE. A rock made of sand cemented together, or merely compressed together.

SANDWORT. Plants of the genus *Arenaria:* they are succulent and harmless.

SANICLE, SANICULA. A genus of umbelliferous weeds.

SANIES. A thin, fœtid discharge from sores.

SAP. The fluid of vegetables and trees. That absorbed from the soil is called the *ascending sap*; it passes to the leaves along the cellular tissue of herbs, and along the new wood (*alburnum*) of trees. In the leaf, by the action of light, it is converted into a mucilaginous fluid, the *elaborated sap*, which, moving from the leaf, is diffused to all parts of the plant along the space between the bark and new wood; out of this sap, new roots, buds, flowers, seeds, and partially the fruit is formed.

SAPAN WOOD. A dye wood resembling Brazil wood.

SAP WOOD. The alburnum, or new wood.

SAP SAGO. A Swiss cheese, flavoured with mellilot.

SAPHENA. The large vein of the thigh.

SAPROPHAGANS. A tribe of coleopterans, many of which feed on decaying matters.

SARCOCELE. A tumefaction of the testes.

SARCOCARP. The fleshy substance of fruits.

SARCOCOLLA. A kind of gum.

SARMENTUM. A runner, such as that of the strawberry.

SARSAPARILLA. The roots of several species of *Smilax* growing in tropical America; the decoction is much used as an alterative.

SASH. In building, a piece of framing for holding the squares of glass in a window. It is of two sorts, viz., that called the French sash, which is hung like a door to the sash-frame; and that in which it moves vertically, from being balanced by a weight on each side, to which it is attached by lines running over pulleys at the top of the sash-frame. When, in a window, both the upper and lower sashes are moveable, the sashes are said to be double hung, and single hung when only one of them moves.

SASSAFRAS. *Laurus sassafras.* A well-known tree, the wood and roots of which are highly aromatic; in poor, worn lands it is little more than a shrub, but on the borders of Southern swamps sometimes attains fifty to seventy feet. The wood is tough and very durable, resisting worms: it is but little known. A beer is made of the bark of the young shoots, boiled with sugar or molasses, and fermented.

SATURATION. A chemical expression, signifying either that no more of a given substance, or salt, can be dissolved; or that, in a compound, the combination of its parts is complete or saturated.

SAUER KRAUT. See *Cabbage*.

SAURIANS. The subdivision of the animal kingdom, including the crocodiles, lizards, &c.; they have four legs, and are covered with a scaly epidermis.

SAVANNAHS. Extensive alluvial flats; the prairies.

SAVIN. *Juniperus sabina*, the leaves of which are a powerful drug. In the United States, the red cedar is often called savin.

SAWDUST. When rotted in the compost heap, or with lime and earth, it forms a good manure for improving the texture of soils.

SAW FLIES. An extensive family of hymenopterous insects, of the genera *Cimbex, Tenthredo, Selandria,* &c. The perfect insects, resembling bees and wasps, are seen in summer hovering over the plants they feed on. The female lays her eggs in a slit made in the young stem, or in leaves; the larvæ, which are called false caterpillars, feed on leaves and buds, and are extremely voracious. In some eight weeks, they descend to the ground and form a web either among the dead leaves, in the bark, or under ground: the grub remains eight months before changing to the fly. They are very destructive: whale-oil soap water, tobacco water, and lime are used to destroy them.

SAW, PRUNING. This is a small saw, set in a long handle, and used to prune trees.

SAVORY. The summer savory (*Satureja hortensis*) is an annual, and propagated by seed; the winter (*S. montana*) is perennial, and managed in the same way as sage, which it greatly resembles. They are labiate plants.

SAXIFRAGE. Flowering plants of the genus *Saxifraga*.

SAXON BLUE. A solution of indigo in sulphuric acid, used as a dye.

SCAB. A disease of sheep.

SCABIOUS. Weeds of the genus *Scabiosa*, at one time celebrated for curing the itch.

SCABROUS. Rough, from minute inequalities.

SCAFFOLDING. The temporary frame-work put up in building.

SCALDED CREAM. Clotted cream; cream raised from milk by heating.

SCALLION. A kind of *Onion*, which see.

SCALPEL. A small knife, convenient for dissections or surgical operations.

SCAMMONY. The gum resin of the *Convolvulus scammonea*, an Eastern plant. It closely resembles jalap.

SCANDENT, SCANDENS. Climbing branches.

SCANSORIALS, SCANSORES. Climbing birds, as the woodpeckers: they have two toes before and two behind on each foot.

SCANTLING. "In building, the measures of breadth and thickness of a piece of timber or other material. It is also the name of a piece of timber when under five inches square."

SCAPE. A flower stem or peduncle rising from the ground, as in the hyacinth, flag.

SCAPULA. The shoulder-blade.

SCAPULARS. The shoulder feathers which cover the sides of the back in birds.

SCAPUS. The stem of a feather. In architecture, a shaft.

SCARABÆIDANS. A family of lamellicorn beetles.

SCARCEMENT. A rebate or set back in a wall, or bank of earth.

SCARFING. The union of two timbers, to answer as one: they are made fast by bolts.

SCARFSKIN. The epidermis, a delicate covering of the true skin.

SCARIFICATOR. A cupping instrument.

SCARIFIER. An implement between the harrow and cultivator for pulverizing the soil. See *Cultivator.*

SCARLET DYE. *Preparation.*—For each pound of cloth take 14 drachms of cream of tartar; when the water boils and the tartar is all dissolved, pour in 14 drachms of solution of tin, and let the whole boil a few minutes: introduce the cloth, boil two hours, let it drain and cool.

For the Colour Bath.—For each pound of cloth take two drachms of cream of tartar; when the bath begins to boil, add one ounce of fine cochineal powder, stir well with a willow switch, and let it boil for a few minutes; pour in gradually one ounce of solution of tin, stirring continually. Introduce the prepared cloth and dye as quickly as possible: it will be a beautiful scarlet. In the colour bath, two ounces of solution of tin may be taken, and no cream of tartar.

SCELIDES. The posterior or lower extremities.

SCHAPHOID. Shaped like a little boat.

SCHEELES GREEN. Mineral green, arsenite of copper.

SCHIST. A coarse slate.

SCIATIC. Relating to the hip joint, as the sciatic nerve.

SCIRRUS. An indurated gland; it becomes a cancer when suppuration occurs.

SCIURINES. The squirrel family.

SCLEROTICA. The white membrane of the eye.

SCOLOPENDRÆ. The genus of centipedes.

SCOPIPEDS. A tribe of melliferous insects, some of which have the posterior feet furnished with a *scopa*, or little tuft of hair.

SCORE. 20 pieces, or 20 pounds.

SCORIÆ. Cinders, especially of the forge.

SCORZONERA. *Scorzonera Hispanica.* "This plant has long been raised in British gardens for culinary purposes, and especially as an ingredient in soups, on account of its palatable and nourishing roots. Some boil and eat them like carrots, &c., in which case they should be deprived of their rind, and immersed in cold water for half an hour, or they will be bitter. They are raised precisely in the same manner as salsify. If the seeds be sown in April, in a good deep soil, the roots will attain perfection in autumn, and continue good all the winter. They last from three to four years, according to the quality of the earth and the care bestowed upon them; but it is better to raise a few from seed every year."—(*Bridgeman.*)

SCOURING. Excessive purging. See *Ox*, *Sheep*, &c.

SCRAPER. An implement to scrape roads, like the *mouldebeart.*

SCREEDS. Wooden rules for running mouldings.

SCREENING. Sifting by passing through a screen such as masons use.

SCROFULA. A disease of the glands about the neck, followed by debility and skin diseases.

SCRUPLE. Twenty grains; the third of a drachm.

SCUFFLER. A light scarifier, or horse hoe.

SCUTATE. Protected by large scales.

SCUTELLIFORM. Of the figure of a shield; leaves having the footstalk terminating in the centre of the lamina.

SCURVY GRASS. *Cochlearia officinalis.* A plant belonging to the same genus as the horseradish, and sometimes cultivated for its leaves. It is propagated by seed, and prefers a moist soil.

SCUTCHING. Breaking flax or hemp. See *Flax.*

SCYTHE. "The common scythe is an instrument too well known to require a minute description, but as much of its utility in agriculture depends on a correct adjustment of its parts, we shall briefly advert to them. The blade of the scythe, which is always curved, with the cutting edge on the concave side, is fixed to the handle at an angle both to the plane of the blade, and to the tangent to the curve. It is on the nice adjustment of these angles that the perfection of the instrument depends. A scythe must cut the corn or grass, especially the latter, as near to the ground as possible, and where the land lies flat and the stones have been removed from the surface, a good scythe, in the hands of a skilful mower, will cut the grass so near to the ground that little or no stubble is left. Every farmer knows well that an inch of the grass near the ground adds more to the weight of the hay than several inches higher up, and that a skilful mower, with a good scythe, can easily add much more to the value of the crop than his earnings amount to, however liberally he may be paid, and that it is of the greatest importance that none but the best mowers be intrusted with the work, and that attention be paid to the form of their scythes, and to their being frequently whetted.

"In some countries the handle of the scythe is nearly straight, and the end of it passes over the upper part of the left arm. The position of the mower is then nearly erect, and his body turns as on a pivot, carrying the blade of the scythe parallel to the ground, and cutting a portion of a considerable circle. The position of the handle in this case must be such that when the scythe is in the middle of its swing, and the blade parallel to the ground, it rests naturally on the left arm above the elbow, while the mower is nearly in an erect position. By turning his body to the right, and stooping towards that side, he begins his cut, and by raising himself up, the muscles of his back greatly assist in swinging the scythe round.

"The blades of the scythes on the Continent are mostly made of soft steel, and they are so soft that the edge can be hammered to sharpen it and keep it thin. In England the scythes are forged thin and well tempered, and to prevent their bending they have a rim of iron along the back to within a few inches of the point. This saves much time in sharpening, and they very seldom require the grindstone.

"Most scythes have two projecting handles fixed to the principal handle, by which they are held, and these are variously put on, according to the fashion of the district. The real line of the handle is that which passes through both the hands and ends at the head of the blade. This may be a straight line or a crooked one, generally the latter, and by moving these handles up or down the main handle, each mower can place them so as best suits the natural size and position of his body. Hence it is that one man can seldom mow well with another man's scythe.

"In mowing grain when ripe, which is the best mode of reaping, the scythe need not have so great a sweep, nor is it necessary to cut the straw so near to the ground. The great difficulty here is to lay the cut grain evenly, so that the binders can readily collect it and tie it into sheaves. When the grain is only slightly bent down, a scythe with an addition of a cradle collects the slanting straw more easily. The cradle is a species of comb, with three or four long teeth parallel to the back of the blade, and fixed in the handle. This inserts itself behind the straw to be cut, raises it up, and, by a peculiar twist of the scythe after the stroke, it is left so as to be easily collected. Those who are accustomed to use the cradle-scythe do the work rapidly and well.

"When the grain is much laid and entangled, it is impossible to use the common scythe, even with a cradle. This has probably suggested a scythe to be used with one hand, while a hook in the other gathers the straggling grain. The most perfect of these scythes is called the *Hainault scythe*, from a province of that name in Belgium, where it was first noticed. It is commonly used in different parts of the Continent. The Hainault scythe is swung by the power of the wrist principally. It does not cut the straw by so oblique a stroke as the common scythe, but rather as a bill-hook or axe would do, meeting the straw nearly at right angles. The hook collects a small bundle, which is severed at a stroke, and the left foot assists in holding what is cut and rolled together with the hook, in the hollow of the blade. It is thus laid aside, and fit to be tied up. This instrument is a great improvement on the English fagging-hook, which is used in the same manner, the left arm of the reaper acting the part of the hook; but as the handle is inserted in the plane of the blade, it causes the reaper to stoop low, which is fatiguing to the loins, especially of elderly people, who can more readily reap with the Hainault scythe.

"The scythe is an instrument which should be more generally introduced in harvest, and experience has proved that it has many advantages over the sickle or reaping-hook." See *Harvest*.

SEA-KALE. See *Kale, Sea*.

SEAM. In geology, a thin layer of a given rock between large masses. Also, a measure of eight bushels, or a horse-load of wood.

SEA MUD. The muck, or mire, of salt marshes.

SEA WARE. See *Weeds*.

SEA WATER. This has been used as a manure near the shore, occasionally with good effect. It is useful to apply it over compost heaps containing lime, as the whole is much improved in fertilizing power.

SEA-WEEDS. They are used as manure in the fresh state, being turned into the soil as soon as spread. As they contain nearly ninety per cent. water, the quantity to be applied is very great. Some farmers waste them by allowing the weeds to dry.

It is more common and better to put them into composts and farm-yard manure; the pig-pen is a favourite place to cast sea-weed into. They decompose rapidly, and will even act as a ferment to peat, and are fertilizing from the large amount of salt and nitrogen they contain.

SEBACEOUS GLANDS. The minute glands of the skin, which excrete a fatty matter.

SEBACIC ACID. An acid produced during the destructive distillation of fats.

SECALE. Ergot. See *Rye*.

SECHIUM. A new vegetable fruit, resembling a small squash in size, but different in flavour and structure, said to be from the *Sechium edulis*, a South American plant.

SECONDARY ROCKS. The formations lying above the coal and between it and the tertiary series. They are fossiliferous and stratified.

SECRETION. The separation from the blood or sap of certain products, by a glandular or other apparatus; the perspiration, urine, bile, saliva, &c., are secretions. They perform important offices in the economy, and cannot be arrested without the occurrence of disease.

SECUNDINE. The second envelope of the ovule in plants. The word *secundines* also means the membranes which cover the animal fœtus.

SECURIFERS, SECURIFERI (from *securis, a hatchet*, and *fero, I bear*). The name of a tribe of *Terebrantia*, or boring hymenopterous insects, comprising those in which the females have a saw-shaped or hatchet-shaped terrebra or appendage to the posterior part of the abdomen, for the purpose of preparing a place to receive the eggs, and of depositing them therein.

SECURIPALPS, SECURIPALPI (from *securis, a hatchet*). The name of a family of coleopterous insects, comprehending those in which the maxillary palps terminate in a joint which is elongated and hatchet-shaped.

SEDATIVES. Medicines which produce sleep and diminish pain, as henbane, camphor, morphia.

SEDGES. Plants of the genus *Carex*, perennial, coarse false grasses, inhabiting marshes and wet places for the most part.

SEED. The reproductive part of the plant. It is usually enclosed within a carpel or ovarium, except in pines, which are gymnospermous, or have the seeds placed in an open carpel. Seeds consist of an external coat or testa, an embryo, and one or two seed lobes (*cotyledons*). They reproduce the species, and not the variety of the plant, and in this respect differ from buds and bulbs. The finest plants should be selected for seed, and only the principal grain stems allowed to remain, the small side branches being pruned off.

The seed is a reservoir of the most nutritious parts of the vegetable, containing often ten times more nourishment than any other part. In sowing, sound, plump, and well-matured seeds only should be selected, and this is done by screening and then steeping in a brine sufficiently strong to float an egg, rejecting the grains that float. The vegetative power of seeds kept in the usual way is often much impaired

		Time of Sowing.	Broad-cast.	Drill.	Dibbled.
Wheat		September to November	$2\frac{1}{2}$ to $3\frac{1}{2}$ bush.	2 to 3 bush.	$1\frac{1}{2}$ to 2 bush.
Oats		March and April	4 to 6 "	$3\frac{1}{2}$ to $4\frac{1}{2}$ "	$2\frac{1}{2}$ to 3 "
Barley		March to May	3 to 4 "	$2\frac{1}{2}$ to $3\frac{1}{2}$ "	——
Rye		September	$2\frac{1}{2}$ to $3\frac{1}{2}$ "	2 to 3 "	——
Beans		March and April	3 to 4 "	$2\frac{1}{2}$ to $3\frac{1}{2}$ "	2 to 3 "
Pease		March and April	$3\frac{1}{2}$ to $4\frac{1}{2}$ "	3 to 4 "	3 "
Buckwheat		April	2 to $2\frac{1}{2}$ "	2 "	——
Clover, Red		March and April	12 to 16 lbs.	10 to 14 lbs.	——
——, White	Mixed seeds	" "	3 to 4 "	——	——
Trefoil	Mixed seeds	" "	2 "	——	——
Red Clover	Mixed seeds	" "	2 "	——	——
Rye Grass		" "	1 peck	——	——
Turnips		May to August	2 to 3 lbs.	$1\frac{1}{2}$ to 2 lbs.	——
Mangel-wurzel		April and May	——	——	——
Potatoes		March to June	——	20 to 25 bush.	——

in two or three years, but if kept absolutely dry, or out of the contact of air, some retain their vitality for ages.

Manuring the seed by steeps, and rolling them in mixtures of blood and lime, &c., has of late been practised with great success; at all events, it seems to destroy rust and many insects.

The preceding table shows the quantities of seed usually sown in England per acre. They exceed our applications, but their harvests are very superior.

SEED LIP. A sowing basket.

SEED LOBES. The fleshy substance of the seed, the *cotyledons:* there are two in *dicotyledonous* or exogenous plants, but one in endogens, such as grasses, cerealia, palms.

SEEL. A season.

SEGMENT. A slice, a portion cut from a solid by a line or plane.

SELENITE. Crystallized sulphate of lime.

SELENIUM. An elementary body closely resembling sulphur. Selenic acid is isomorphous with sulphuric acid: it is very rare.

SELLENDERS. A skin disease of the bend of the hock in horses, produced by want of cleanliness: the part is to be kept clean.

SEMEIOTIC. Relating to the signs or symptoms of diseases.

SENEGA ROOT, SENECA SNAKEROOT. *Polygala senega.* A perennial-rooted, common plant, especially in the South, the roots of which are used as an expectorant: it is not to be trusted as a remedy for snake bites.

SENNA. *Cassia* (*acutifolia*, *obovata*, &c.,) *senna.* A small leguminous shrub of Africa and Arabia, the leaves of which are much employed in decoction as a purge. The Maryland senna (*C. Marylandica*) is of the same genus, but a perennial herb; it grows from four to six feet high: the leaves should be collected in August and carefully dried.

SENSIBLE FROG. The part of a horse's hoof immediately above the bony covering; the fleshy sole.

SENSITIVE PLANTS. Plants or shrubs of the genus *Mimosa*, whose leaves fold when touched, or shaded from the sun.

SEPALS. The leaflets of the calyx.

SEPTUM, SEPTA. A partition, especially in a seed vessel.

SEPTARIA. Large nodules or masses of a marly clay found in some geological formations; when burned, they form Roman cement, which has the property of hardening under water.

SEPTEMBER. This is the month for sowing wheat; corn is gathered, and preparations are made to fatten off the stock for sale; prepare for making cider, and let the root crops be hoed and kept in good order, for they grow much this month: potatoes are to be taken up as soon as the vines die.

In the garden, fall crops are to be attended to; budding can also be practised on some trees. In the South, tobacco is ripening, cotton is to be picked, and preparations for the sugar harvest are to be made at the end of the month. Wheat, rye, and winter barley are to be sowed.

SEPTIC. Substances or causes hastening putrefaction.

SERICEUS. Silky, covered with short, soft hairs.

SERICIC or MYRISTIC ACID. An oily acid obtained from the butter of nutmegs.

SERON. A buffalo's hide used for packing drugs.

SEROSITY, SEROUS FLUID. See *Serum.*

SERPENTINE. An injected rock of a greenish colour, consisting of a silicate of magnesia (43 per cent.), with various proportions of iron and alumina.

SERRATE. Having an edge cut into sharp teeth, like a saw.

SERRICORNS. A coleopterous family, many of which have serrated antennæ.

SERUM. The fluid portion of the blood; it consists of a solution of albumen in soda, with salts, and contains 7 per cent. solid matter: in the form of a secretion from membranes, it is called serosity, or serous fluid. The whey of milk.

SERVICE. *Pyrus torminalis.* A small tree of the apple genus, the fruit of which, when half decayed, is eaten, and closely resembles the medlar: they are small. The *P. domestica* yields a better fruit of the same kind.

SESAMOID (from *σησαμη, a seed*). Small bones not larger than a pea, found at the joints of the toes and fingers.

SESASUM. See *Bene.*

SESQUI. One and a half. *Sesquioxide.* An oxide containing three equivalents of oxygen, and two of metal.

SESSILE. Without stalk, sitting on the stem.

SETA. A term used by botanists in various senses. It is the stalk that supports the theca, capsule, or sporangium of mosses; the awn or beard of grasses, when it proceeds from the extreme point of a palea or glume; sometimes the glandular aculeus of roses, and also the abortive stamens or rudimentary perianth of cyperaceous plants.

SETACEOUS. Bristle-like. *Setose,* bristly.

SETON. An artificial ulcer, made by passing a skein of silk or a piece of riband under a portion of the skin by means of an instrument called a seton needle, which is a flat blade with a needle eye; the thread is occasionally anointed with irritating substances, in order to keep up a discharge from the sore.

SETS. The pieces of potato used in planting: when the whole is planted, it is called a whole set.

SETTING. In building, the act of solidifying, as in mortar.

SETT OFF. The projecting part of a wall that is built thinner above than below.

SEXES. In plants, the stamens and pistils; the former being called the male, and the latter the female organs, from a fanciful analogy.

SHAB. The scab of sheep.

SHADDOCK. An inferior but very large orange; the fruit of the *Citrus decumaria.*

SHAFT. The trunk of a column; the entrance or downward excavation of a mine; a handle.

SHAKES IN TREES. Fissures, clefts, rents, or black and rough places in trees or timber.

SHALE. A loose, rotten, or crumbling slate.

SHALLOT. *Alium escalonicum.* It is stronger than the onion, but has a better flavour. The offsets for propagation are set in rows, 12 inches apart, 5 inches in the row, in August and September, and taken up in May.

SHANK BONE. The femur.

SHARE OF A PLOUGH. The point.

SHEARING. "When the sheep are to be shorn, they are driven to a pen or other enclosed space, and brought one by one to the shearers. The sheep to be shorn is first placed upon his rump, and the shearer, with the shears, beginning at the neck, clips in a circular direction down the belly towards the back. The animal is then laid on his side, and kept down by the leg of the shearer, who clips the fleece all round to the back. Turning the animal on the other side, he clips, in like manner, round to the back; then raising the sheep, he clips the part of the fleece not yet cut away, and so lets the animal go, taking care that it shall not entangle itself with the fleece. The fleece, as soon as it is shorn, is taken away by an attendant, spread out, neatly rolled up with the inner surface outmost, and then deposited in some dry place until it is packed in the wool sheets."

SHEARING RIVERS. "The mowing of weeds in rivers and ponds is done in the usual way from a boat, in which the operator stands, and is rowed forward by another as required. Sometimes scythe-blades are tied or riveted together, and worked by means of ropes like a saw from one shore to the other, called shearing; but the first mode is generally reckoned the best, and is unquestionably so in agriculture."

SHEARLING. A sheep once shorn.

SHEARS. A large kind of scissors used in clipping hedges and pruning young branches; they are often worked by a rope at the end of a long handle. Sheep-shears are well known: they have been unimproved in ages.

SHEEP. *Ovis aries.* The following is principally from Mr. Youatt and Mr. Spooner, the two best writers on sheep:

"The sheep belongs to the class *mammalia*, to the order *ruminantia*, with four stomachs, and the organs of digestion disposed for chewing the cud; to the tribe *capridæ*, with horns persistent, and placed on an osseous nucleus; and to the genus *ovis*, with or without horns, but these, when present, uniformly taking, to a greater or less degree, a lateral and spiral direction. The forehead of the sheep is arched, and protruded before the base of the horns; there are no lachrymal ducts; the nostrils are lengthened and oblique, and terminate without a muzzle; there is no beard properly so called; the ears are small, and the legs slender. The hair is of two kinds, one hard and close, and the other woolly, the wool preponderating in proportion as the animal is domesticated.

"There is a breed of sheep now extending over the north and south of Asia, and Palestine, and Russia, and of which the flocks of the Calmucks and Tartars of the present day are almost entirely composed. They are distinguished by two masses of fat commencing at the loins, gradually swelling into a considerable mass towards the rump, and presenting behind two enlargements of a more or less globular form. The owners of the modern improved breeds would find great fault with some points about them; but many of their defects have doubtless been the result of neglect.

"Some naturalists have traced the origin of the sheep to the Argali or the Moufflon. The Argali is a species of mountain-sheep, found in small flocks on the high grounds of Asia, extending from the precipices of Khamtschatka in the north, to those of Mongolia in the centre, and of Caucasus in Western Asia. The Moufion is an inhabitant of Southern Europe, Corsica, Crete, and the islands of the Grecian Archipelago. They congregate in large groups, and possess all the wildness of the Argali. Neither of these, however, has the slightest claim to being the original parent of the sheep. They are descendants of those who have escaped from the dominion of man, and are retreating from desert to desert, in proportion as the population of the country increases.

"It will be most satisfactory to the reader to commence with the history of the British sheep, and then compare with them the breeds and management in other countries.

"Different names are given to the sheep, according to its sex and age. The male is called a *ram* or *tup*. After weaning, he is said to be a *hog*, a *hogget*, or *hoggerel*, a *lamb hog*, or *tup hog*, or *teg*; and if castrated, a *wether hog*. After shearing, and when he is probably a year or a year and a half old, he is called a *shear hog*, *shearling*, *dinmont*, or *tup*; and when castrated, a *shearing wether*. After the second shearing, he is a *two-shear ram, tup, wether*. At the expiration of another year, he is a *three-shear ram*.

"The female is a *ewe* or *gimmer lamb* until weaned, and then a *gimmer* or *ewe hog*, or *teg*. After being shorn, she is a *shearing ewe*, *gimmer*, *theave*, or double-toothed ewe; and after that, a *two*, or *three*, or *four*, or *shear ewe*, or *theave*. The age of the sheep is reckoned, not from the period of their being dropped, but from the first shearing.

"The teeth give certain indications as to the age. The sheep has no incisor teeth in the upper jaw; but there is a dense elastic cushion or pad, and the herbage, firmly held between the front teeth in the lower jaw and this cushion, is partly bitten and partly torn asunder. The sheep has the whole of the incisor teeth by the time that he is a month old, and he retains them until the fourteenth or sixteenth month. They then begin to diminish in size, and are displaced. The two central ones are first shed, and the permanent ones supply their place, and attain their full growth when the animal is two years old. Between two and three, the next pair are changed ; the third at three years old ; and at four, the mouth is complete. After this there is no certain rule, until, two years more having passed, the teeth one by one become loosened and are lost. At six or seven years of age the mouths of the ewes should be occasionally examined, and the loose teeth removed, and then, by good pasture and good nursing in the winter, they may produce lambs until they have reached the ninth or tenth year, when they begin rapidly to decline. Some favourites have lingered on to the fifteenth or sixteenth year ; but the usual and the most profitable method is to fatten and dispose of the ewes when they are five or six years old, and to supply their places by some of the best shearing ewes.

"The rings at the base of the horns afford very imperfect indications of the age of the sheep.

"The history of the sheep will be most naturally divided according to the quantity and quality of the wool of the different breeds, the uses of the skin, and the quantity and quality of the flesh. The covering of the original sheep consisted of a mixture of hair and wool, the wool being short and fine, and forming an inner coat, and the hair of greater length, projecting through the wool, and constituting an external covering. When the sheep are neglected, or exposed to a considerable degree of cold, this degeneracy is easily traced On the Devonshire moors, the mountains of Wales, and the highlands of Scotland, the wool is deteriorated by a considerable admixture of hair. Even among the South Downs, the Leicesters, and the Ryelands, too many *kemps* occasionally lessen the value of the fleece. It is only by diligent cultivation that the quantity of hair has been generally diminished, and that of wool increased in our best breeds.

"*Wool.*—The filaments of wool taken from a healthy sheep present a beautifully polished and even glittering appearance. That of the neglected or half-starved animal exhibits a paler hue. This is one valuable indication by which the wool-stapler is enabled to form an accurate opinion of the value of the fleece. The mixture of hair in the wool can often be detected, by close examination, with the naked eye, but most readily by the assistance of a microscope.

"Among the qualities which influence the value of the wool are *fineness*, and the uniformity of that fineness in the single fibre and in the collected fleece. This fineness, however, differs materially in different parts of the fleece. It prevails on the neck, the shoulders, the ribs, and the back. It is less on the legs, thighs, and haunch, and still coarser on the neck, the breast, the belly, and the lower part of the legs. The fineness of the wool is considerably influenced by the temperature.

"The fineness of the fleece is also much influenced by the kind of food. An abundance of nutriment will increase both the length and the bulk of the wool. This is an important consideration with the sheep-breeder. Let the cold of winter come—let it continue for a considerable period, yet if the sheep is well kept, although the fleece may lose a little weight, this will be more than compensated by its fineness and increase of value. If the sheep, however, be half starved while exposed to unusual cold, the fibres of the wool, although perhaps somewhat finer, will be deficient in weight, and strength, and usefulness.

"That which is called *trueness of staple*, or the fibres being of an equal size, is of much importance in the manufacture of wool ; for whenever the wool assumes an irregular and shagged, or *breachy* appearance, there is a weakness in the fibre, and will be an irregularity in the manufacture, especially if the fleece is submitted to the operation of the comb. Connected with this, and a most important quality, is the *elasticity* of the woolly fibre—the disposition to yield, or submit to some elongation of substance, some alteration of form, when it is distended or pressed upon, and the energy by means of which the original form is resumed as soon as the external force is removed.

"Referrible to this elasticity or yielding character of the wool is its *pliability* and *softness*, and without which no manufacture of it can be carried to any degree of perfection. The last quality which it is necessary to mention is its *felting* property—that quality by which it may be beaten or pressed together and worked into a soft and pliable substance of almost any size and form. It would seem that the process of felting is of far older date than that of weaving; and it is still continued, not only by the nomadic tribes of Southeastern Europe and of Asia, but it is made occasionally to vie with the finest productions of the loom.

"Some late microscopic observations have unravelled the whole mystery of felting, and of the employment of wool in almost every form. The fibre, examined under a powerful microscope, appears like a continuous vegetable growth, from which there are sprouting, and all tending one way, from the root to the other extremity, numerous leaves, assuming the appearance of calices or cups, and each terminating in a sharp point. It is easy to conceive how readily one of these fibres will move in a direction from the root to the point, while its retraction must be exceedingly difficult, if not impossible. It was a fibre of Merino wool that was first submitted to microscopic observation, and the number of these serrations or projections counted. There were 2400 in the space of an inch. A fibre of Saxon wool, finer than that of the Merino, and of acknowledged superior felting quality, was substituted. There were 2720 serrations. A fibre of South Down wool, in its felting power well known to be inferior to that of the Saxony and the Merino, was placed in the field of vision. There were only 2080 serrations in the space of an inch, or 640 less than the Saxony exhibited. The Leicester wool is acknowledged to possess a less felting property than the South Down. There were only 1860 in the space of an inch.

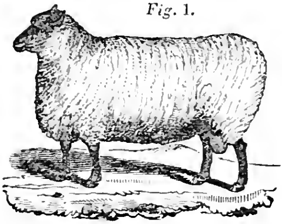
"There can be no doubt as to the structure of the woolly fibre. It consists of a central stem or stalk, from which there spring, at different distances, circles of leaf-shaped projections, possessing a certain degree of resistance or of entanglement with other fibres, in proportion as these circlets are multiplied and they project from the stalk. They are sharper and more numerous in the felting wools, and in proportion as the felting property exists. They are connected with, or, it may be confidently asserted, they give to the wool the power of felting, and regulate the degree in which that power is possessed.

"*Skins.*—The skin of the sheep is often partially tanned, and then used in the common sorts of book-binding; or it is manufactured into parchment, and becomes exceedingly valuable on account of its durability. Immense numbers of lamb skins are dressed in a peculiar way, and converted into gloves with the wool remaining on them, or used, in some countries, for the linings of valuable garments. It is scarcely credible to what degree vanity and cruelty are sometimes carried. The ewe is slaughtered a little before the time when her pregnancy would have expired, and the lamb is taken from the womb and immediately destroyed. It is supposed that the fur nearest to the skin is more beautiful than could have been obtained from the same animal after birth.

"*Varieties.*—It will now be proper to take a rapid survey of the different breeds of sheep, commencing with the *South Downs.* The South Downs and the Hampshire and Wiltshire breeds were formerly, according to Mr. Ellman, of 'a very small size, and far from possessing a good shape, being long and thin in the neck, high on the shoulders, low behind, low on the loins and on the rumps, the tail set very low, perpendicular from the hip-bones, sharp on the back, the ribs flat, but good in the leg, although having big bones.'

"It is pleasing to compare this with the account given by the same breeder of the South Downs (*Fig.* 1) of the present day, the change being effected by him and a few spirited individuals: 'The head small and hornless;

Fig. 1.



the face speckled or gray, and neither too long nor too short; the lips thin, and the spaces between the nose and the eyes narrow; the under jaw fine and thin; the ears tolerably wide, and well covered with wool; the forehead also, and the whole space between the ears, well protected by it, as a defence against the fly.

"'The eyes full and bright, but not prominent; the portion of the frontal bone arching the eye not too prominent, that it may not form a fatal obstacle in lambing.

"'The neck of a medium length, thin towards the head, but enlarging towards the shoulders, where it should be broad and high, and straight in its whole course above and below; the chest wide, deep, and projecting between the fore legs, indicating a good constitution and a disposition to thrive; the shoulders on a level with the back, and not too wide above, but bowing outward from the top to the breast, leaving room for the springing rib behind.

"'The ribs coming out horizontally from the spine, extending far backward, and the last rib projecting more than the others. The back flat from the shoulders to the setting on of the tail; the loin broad and flat; the rump long and broad, and the tail set on high, and nearly on a level with the spine; the hips wide; the space between them and the last rib on either side as narrow as possible, and the ribs presenting a circular form, like a barrel

"'The belly as straight as the back.

"'The legs neither too long nor too short; the fore legs straight from the breast to the foot, not bending inward at the knee, and standing far apart both before and behind; the hocks having a direction outward, and the meeting of the thighs being particularly full; the bones fine, but having no appearance of weakness; and the legs of a speckled, dark colour.

"'The belly well defended with wool, and the wool coming down, before and behind, to the knee and to the hock; the wool short, close, curled, and free from spiry, projecting hairs.

"'The South Down is adapted to almost any situation in the northern and middle parts of the United States. It has a patience of occasional short keep and an endurance of hard stocking equal to any other sheep; an early maturity scarcely inferior to the Leicesters, and the flesh finely grained and of good flavour.'

"According to Mr. Ellman, the artificial food resorted to at the beginning of spring, and soon after lambing, is green rye; but it must be very cautiously given, on account of its occasionally producing diarrhœa or dysentery. This bad effect, however, may be prevented by removing the ewes, once in the day, to old pasture ground.

"The rye being fed off or running to seed, the ground is ploughed in May for turnips or rape. Rye grass succeeds to the rye until the latter end of June, when clover, lucern, or sainfoin will come in. One crop should follow another in proportion as it is wanted.

"Tares, clover, or rape next take

their turn; the tares, perhaps, are somewhat inferior to the others. As a winter food, the ruta baga or beets come in until lambing time, but not after that, lest it should produce purging in the lambs.

"About the middle of October the rams are admitted to the ewes, and a plentiful allowance of nutritious and stimulating food will have considerable influence in increasing the number of lambs. Much to the credit of the breeder, great care is taken of the sheep during the lambing time. The ewes are either driven home, or there are sheltered places constructed in the fields.

"The average dead weight of the South Down wether varies from eight to eleven stones; but at the Christmas show there are usually some pens in which the weight is double that. The average weight of the fleece used to be two pounds; but, from the altered system of management, it is now at least three pounds in the hill sheep, and nearly four pounds in the lowland sheep. This wool has likewise changed its character. It has become a combing instead of a carding wool. Formerly devoted to the manufacture of servants' clothing, or being sparingly mixed with other wool, it is now used for flannels, and baizes, and worsted goods of almost every description; thus becoming of considerably increased value. The hogget wool is particularly improved; it is finer than the other long wools, and is applicable to many new and valuable purposes.

"The South Down sheep have succeeded admirably in all the southern districts of the kingdom; but the northern hills have occasionally been too cold for them. Crosses between the South Down and almost every breed of middle-wool sheep have answered well; while in counties where it could have been least expected, the old breed is, in a great measure, superseded by the South Downs.

"In Kent many South Downs are kept, and much prized; but on the marshes and their neighbourhood they have given way to the Romney Marsh sheep.

"The South Down differ materially in the different districts of Surrey. In some of the lofty and barren heaths a small and profitable sheep, distinguished by the name of the Bagshot, still prevails. The old Wiltshire sheep are occasionally seen here, while the Dorsets have possessed themselves of many extensive districts, and are employed in supplying the London market with early lambs. Still, however, the South Downs are numerous, and vie with any of the others in excellence and profit.

"The old Wiltshire breed of sheep, the largest and the heaviest of the fine-woolled sheep, has gradually passed away. They were crossed by the South Downs until every trace of the old breed had vanished, and a useful variety remained, which would have been called true Sussex sheep, only they were of a somewhat larger size and lighter colour, and a lighter, finer fleece. This breed is now rapidly yielding to the true South Downs. In the lower land pastures of Wilts a breed is found evidently derived from the South Downs, but larger in size, and with a heavier fleece.

"In Dorsetshire we find a very different and valuable breed of sheep; they are white, the face long and broad, with a tuft of wool on the forehead; the shoulders low but broad; the chest deep; the loins broad, and the bone small: a hardy and useful sheep. Their chief peculiarity is the forwardness of the ewes, which supply the market with lamb when it produces the highest price. If they have plenty of nutritious food, the ewes will be in lamb as early as April, so that the young one will drop in September, and be ready for the market at Christmas.

"*The Ryelands.*—They are small, polled, with white faces, the wool growing close to and almost covering the eyes, the carcass round and compact, the animal quickly fattening, and the superabundant fat accumulating within; they are hardy, and peculiarly free from disease; they are particularly distinguished by the fineness of their wool. The number and the nature of the serrations place it precisely where the manufacture had long done. It is decidedly superior in fineness and in fulness to the South Down, but yields in both of these qualities to the Merino wool. It was attempted to cross the Ryeland sheep with the Merino, in order to increase the value of the wool. To a certain extent this was accomplished, but it was at the expense of the carcass. The Merinos were then crossed by the Ryelands, with a view to the improvement of form, and greater tendency to fatten, but this also failed. While these experiments were proceeding, arrived the period when the fleece of the short-woolled sheep, both the South Down and the Ryeland, was materially changed by the altered system of sheep-husbandry that was introduced, and the wool of both was rejected by the manufacturer for the purposes to which it had hitherto been applied.

"The Delamere sheep is the only short-woolled breed deserving of notice in Cheshire. The wool is short and fine, and still used by some manufacturers, but it is no longer used for any of the fine cloths.

"The different districts of South Wales afford a small and valuable breed of sheep, principally used for the supply of the London market, where the Welsh mutton is in considerable request. These sheep seem scarcely to have changed their character for many centuries. but some crosses of the South Downs have been lately introduced, and even some flocks of this sheep have begun, and with much prospect of advantage, to spread over the lower part of the country.

"In North Wales, and particularly in Anglesea, the old South Down reappears, or a sheep whose likeness to the unimproved South Down is too striking to escape observation. The purest and best blood that the mountains of Wales are now supposed to be capable of producing is found at the foot or on the declivities of Cader Idris. All the hills of North Wales are covered with sheep, which are sent in the spring from all parts of the low country. The strongest wethers remain on the mountains during the winter, and without the slightest artificial provision for their support; the others are brought down to the low ground about Michaelmas, to be returned in the spring.

"The *Cheviots* extend from Westmoreland far into Scotland; their birthplace, or where they were originally observed, and are still found in their greatest purity, is the Cheviot Hills in Northumberland. They differ essentially from both the black and the dun-faced breeds by which they are surrounded; but neither history nor tradition has given the slightest clew to their origin. The following is a description of the pure breed, thirty years ago, before they began to be crossed by the Leicesters: 'The head polled, bare and clean, with jaw bone of a good length; ears not too short, and countenance of not too dark a colour; neck full, round, and not too long, well covered with wool, but without any coarse wool depending beneath; shoulders deep, full, and wide; chest full and open; chine long, but not too much so; straight, broad, and wide across the fillets; horns round and full; the body in general round and full, and not too deep or flat either in the ribs or flanks; the fleece fine, close, short, and thickset, of a medium length of pile, without hairs at the bottom, and not curled on the shoulders, and with very little coarse wool on the hips, tail, or belly.'

"Sir John Sinclair adds the following account of them: 'Perhaps there is no part of the whole island where, at first sight, a fine-woolled breed of sheep is less to be expected than among the Cheviot Hills. Many parts of the sheep walks consist of nothing but peat bogs and deep morasses. During winter the hills are covered with snow during two, three, or even four months, and they have an ample proportion of bad weather during the other seasons of the year, and yet a sheep is to be found that will thrive even in the wildest part of it. Their shape is excellent, and their fore quarters, in particular, are distinguished by such justness of proportion, as to be equal in height to the hinder ones, which enables them to pass over bogs and snows through which a shorter-legged animal could not penetrate. They have a closer fleece than the Tweeddale and Leicester breeds, which keeps them warmer in cold weather, and prevents either rain or snow from incommoding them. They are excellent snow-travellers, and are accustomed to procure their food by scraping the snow off the ground with their feet. They have never any other food but the grass and natural hay of their own fields, except when it is proposed to fatten them. They weigh from 12 to 18 pounds per quarter, and their meat is fully equal to any that the Highlands can produce.'

"The wool is inferior to that of the South Downs. It is not so fine as before the attempted improvement of the carcass; and the use of it is abandoned in the manufacture of fine cloth.

"There are many flocks of pure Cheviots, but in the majority of the flocks there is a cross of Leicester blood.

"The other breed of short-woolled sheep which contend with the Cheviots in number and value is the *black-faced Scots*; they extend from Lancashire to the very north of Scotland. The males are mostly horned, the horns of a spiral form, but the females are frequently without horns. The faces and legs are always black or mottled; they are covered with wool about the forehead and lower jaw; the fleece is long and somewhat coarse. The carcass is peculiarly compact; so much so, that on account of the shortness, roundness, firmness, and handsomeness of the carcass, it is called the *short* sheep, in opposition to the Cheviots, or *long* sheep. The weight of the carcass does not differ materially from that of the Cheviot, and the fleece weighs about three pounds after it is washed. These sheep have been improved by selection, but have derived little advantage from any of the crosses that have been tried.

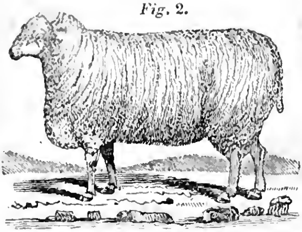
"As these are the prevailing breeds in the northern parts of the kingdom, if not to the exclusion of the short horns and the Leicesters, yet, being far more numerous than they, it may not be uninteresting to institute a brief comparison of their respective merits. The three important points with respect to sheep in such localities are the weight and value of the wool, the carcass, and the degree of hardihood.

"As to the wool there can be no question. The weight of the individual fleece may be somewhat, but not a great deal, in favour of the black-faced breed; but in point of value and the price which the wool will obtain, the advantage is most decidedly in favour of the Cheviots. As to the carcass, the Cheviot is ready for market a full twelvemonth before the other. If so many sheep cannot be kept on the same quantity of ground, the quantity of meat that can be produced is greater, and consequently the profit of the farmer is greater; and as to hardihood, they are both of them excellent breeds, and it might be difficult to decide which wool would most successfully endure the hardships of a Highland winter. The adjudication, on the whole, is most decidedly in favour of the Cheviot breed, with this exception, perhaps, that on the wildest of the Grampian, or other similar hills, the black-faced mountain sheep may have the best chance of doing well; and the acknowledged fact is, that in almost every northern district the Cheviots are rapidly superseding the native black-faced sheep.

"*Long-woolled Sheep.*—There is much more similarity between the varieties of the long-woolled sheep than those of shorter fibre. The deficiency of horns, the form of the head, the expression of the countenance, and the white faces and legs, show that they had one common origin; while the colour and weight, and uses of the wool, speak their common origin.

"The following description of the *new Leicester* (*Fig.* 2), by Mr. Culley,

Fig. 2.



will, to a very considerable degree, serve for all the varieties of the long-woolled sheep. The head should be hornless, long, small, tapering towards the muzzle, and projecting horizontally forward. The eyes prominent, but with a quiet expression. The ears thin, rather long, and directed backward; the neck full and broad at its base, but gradually tapering towards the head, and particularly fine at the junction of the head and neck. The neck seeming to project straight from the chest, so that there is, with the slightest possible deviation, one continued horizontal line from the rump to the poll. The breast broad and full; shoulders also broad and round, and no uneven or angular formation where the shoulders join either the neck or the back, particularly no rising of the withers, or hollow behind the situation of those bones. The arm fleshy through its whole extent, and even down to the knee. The bones of the legs small, standing wide apart, no looseness of the skin about them, and comparatively bare of wool. The chest and barrel are at once deep and round in the ribs, forming a considerable arch from the spine, so as in some cases, and especially when the animal is in good condition, to make the apparent width of the chest even greater than the depth. The barrel ribbed well home. No irregularities of line on the back or the belly; but on the sides the carcass very gradually diminishing in width towards the rump. The quarters long and full, and as wide as the fore legs. The muscles extending down to the back, the thighs also wide and full. The legs of a moderate length; the pelt also moderately thin, but soft and elastic, and covered with a good quantity of white wool, not so long as in some breeds, but considerably finer.

"Such is the Leicester sheep as Bakewell made him. He found him as different an animal as it was possible to conceive—flat-sided, large-boned, coarse-woolled, slow to fatten, and his flesh of little value. Were there room for its insertion, a detailed history of the different steps of the changes would be most interesting to the reader. The means were simple, and the effect was almost magical. The principle was, that 'like produces like;' and therefore he selected a few sheep with aptitude to fatten, with a disposition to produce an unusual quantity of valuable meat, with little bone and offal, and with quietness of temper; and from these he exclusively bred. He cared not about near or distant affinities; but his object was to increase every good point, and gradually to get rid of every bad one. They were not different sorts of sheep that he selected, but the best of the breed to which he had been accustomed.

"Such was the origin and the eventual triumph of the new Leicester breed of sheep. They have spread themselves to every part of the kingdom. There are few other varieties of long-woolled sheep which do not owe much of their excellence to the new Leicesters, and even some of the short-woolled flocks are deeply indebted to the breed introduced by Bakewell. There is no other species of sheep that possesses so decided a propensity to fatten, or that is prepared for the butcher at so early an age. It will not, however, thrive on a poor soil, nor if it is compelled to travel far in order to procure its food; but on soils of a moderate quality there is no other sheep so profitable. Other breeds, as the Teeswater and the Lincoln, may be superior in size, but it is at an expense of time and of food, and, eventually, a palpable deterioration of flesh and diminution of profit. The new Leicesters, on fair keep, will yield a greater quantity of meat, for the same quantity of food, than any other breed of sheep. The meat is of a peculiar character. It is disliked by some on account of a supposed insipidness. The fatty matter is too much introduced between the muscular fibres, and there may be the appearance and the taste of a mass of fat. This, however, is the fault of the breeder, and not of the animal: it marks the point to which the fattening process should be carried, and where it should stop. It is the fault of the grazier if he converts that which is an excellence into a fault.

"There are accounts of the Leicester sheep attaining a very great weight. Two prime wethers exhibited by Mr. Painter at the Smithfield cattle show, in 1835, weighed 165 and 155 pounds. It should, however, be remarked that the new Leicester sheep has a smaller quantity of bone, in proportion to its weight, than any other sheep.

"The deficiency of the fleece was formerly objected to in the new Leicester sheep. The truth of the matter was, that with the early breeders the fleece was a perfectly secondary consideration, and comparatively disregarded. There is now little cause for complaint on this head. The wool has considerably increased in length, and it has improved both in fineness and strength of fibre. It averages from six to seven pounds the fleece, and the fibre varies from five to more than twelve inches in length. Like all other British wools, it is applied to a purpose different from that to which it was formerly devoted, and is mostly used in the manufacture of serges and carpets.

"The chief value of the new Leicester breed consists in the improvement which it has effected in almost every variety of sheep with which it has been crossed. Most of the breeders of the South Downs were at first averse to admit a cross with the Leicesters; but when the wool of the South Downs began to be applied to purposes very different from those to which it had been formerly devoted, a cross with the Leicesters was reluctantly attempted. A sheep was produced, probably not so hardy, but coming earlier to the market, yielding a longer and a finer fleece, of nearly double the weight, and with a combing wool adapted for many valuable purposes.

"A short account must be given of the other breeds of long-woolled sheep, although some of them are rapidly passing away. The *Teeswater*, inhabiting the southern districts of Durham and the north of Yorkshire, was once in considerable request on account of the weight of its carcass, the goodness of its flesh, and the remarkable degree in which the ewes were prolific. Its greatest fault was that it was too heavy for the lowlands in which it was placed, and the pasture was trodden down and destroyed. Some of the Leicesters found their way to the banks of the Tees, and the old breed was crossed by them. The carcass became somewhat smaller, but it was more compact and profitable. More mutton was produced on the same quantity of land; and, after a considerable time, for the improvement was always slower with regard to the wool than the flesh, the fleece became finer and closer. The old breed gradually diminished and almost disappeared.

"The largest and most ungainly breed of sheep was the *Lincolns*, 'hornless, with long, thin, and weak carcasses, large bones, weighing from twenty to thirty pounds a quarter; the wool averaging from eight to twelve pounds the fleece; the sheep a slow feeder, and the flesh coarse-grained.' This is the account given of them by a good but a prejudiced observer, Mr. Culley. In fact, while Bakewell and his admirers were almost neglecting the fleece, the Lincolnshire farmer was quite as inattentive with regard to the carcass. Both parties were wrong. The old

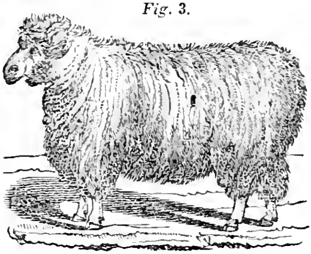
Lincolnshire sheep yielded a wool which in quantity and in quality was unrivalled, while the Leicesters could boast of a disposition to fatten which the other could never equal. At length the attempt was honestly made to amalgamate the valuable qualities of the two breeds. In consequence of the cross, the wether attained its maturity a full year sooner than it was accustomed to do, and the fleece became finer and improved in colour, but it was shorter and more brittle, and not fitted for some of its former purposes. On the whole, a great improvement has been effected both in the carcass and the fleece; and so satisfactory did this prove, that it is now difficult to find any sheep in Lincolnshire that have not been crossed with the Leicesters. This cross is deeper on the wolds than in the marsh lands, which may serve to account for the difference of the fleece in the two. The breed of these sheep generally has been greatly increased since the introduction of the turnip system.

"Among the long-woolled sheep that have been improved by the admixture of the old and new long-woolled breeds and the altered system of husbandry, the *Romney Marsh* must not be forgotten. From time immemorial the produce in wool and the thickness in stocking were scarcely equalled in any other breed or situation. The Kentish men obstinately resisted every encroachment on their favourite breed, and predicted disappointment and loss in every possible form. For a while it seemed as if they had reason on their side, for the size of the sheep was considerably lessened, and the wool was not so valuable, nor yielded in its former quantity. By degrees, however, it began to be found that these smaller, deeper, closer, and more compact sheep weighed heavier than the old long-legged and long-bodied ones; that they did not consume so much food, that the hard stocking of former days might be increased, that they were ready a full year sooner for the market, and therefore became far more profitable. That the fat formed more on the exterior of the animal, where it was advantageously placed for the farmer and the consumer, and did not accumulate within for the profit of the butcher alone: and that, by careful selection, although the wool was somewhat shorter and lighter, it was improved in firmness and colour and felting property.

"Some valuable breeds of long-woolled sheep are found in the South Hams in Devonshire, extending from Axminster to Dartmoor, and from the north of Devon to the vale of Taunton, under the name of the Bampton sheep, and also, but smaller in number and size, in the neighbourhood of Exmoor.

"The *Cotswold sheep* (*Fig.* 3), so

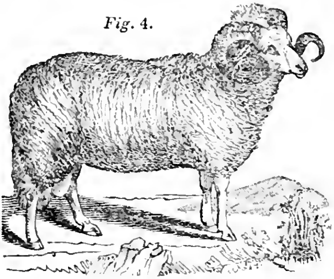
Fig. 3.



called from the cots or sheds in which they were housed, formerly inhabited the counties of Gloucester, Hereford, and Worcester. They were a long-woolled breed, yielding, formerly, a description of wool much valued on account of the fabrics in the construction of which it was employed. Even they, like the rest, have amalgamated themselves with and been, in a manner, lost among the Leicesters. They were taller than the present sheep, flat-sided, deficient in the fore quarter, but full in the hind quarter, not fattening so early, but yielding a long and heavy fleece. Many of these good qualities have been preserved, and to them have been added that which is of so much importance to the farmer, the capability of rearing and fattening so many more sheep on the same quantity of land, and of bringing them so much earlier to the market.

"*Spanish Sheep.*—The English wool being, from the increased coarseness of the fibre, rejected by the manufacturer in the constrution of fine cloths, recourse was had to foreign wools, and to those chiefly that were derived from the Merino sheep (*Fig.* 4).

Fig. 4.



As early as the commencement of the Christian era, the wool of the Spanish sheep was in great request for the production of the most costly dresses. In less than half a century afterward we find Columella busily employed in improving the Spanish sheep, and the effect of his labours remained during the long dark ages that succeeded. The Merino flocks withstood the baneful influence of almost total neglect, and continued, to a greater or less degree, to furnish the finest and the choicest wool.

"By degrees the Merino sheep found its way to almost every part of the European continent, and by careful management its fleece rapidly increased in fineness and in usefulness. In 1834, the prime wool produced in Spain readily found a sale at from 3*s*. 6*d*. to 4*s*. per lb. In Saxony it reached to 5*s*. 3*d*. per lb., and in some parts of Hungary to 5*s*. 6*d*. In Australia the cultivation of the Merino sheep and its fleece has proceeded most rapidly and prosperously.

"The Merino sheep are small in size, with flat sides, narrow chests, and long legs. The wool is usually white, but darker on the legs, and face, and ears, and a tuft of coarse wool is found on the forehead; the skin is of a reddish colour, and there is a looseness of the skin under the throat, which is considered favourable, as indicative of good fleece. The males have large spiral horns, but the females are without any. With these peculiarities, it must be evident that, as regards the carcass, the Merino is by no means a profitable animal, and to this must be added, that they are bad nurses, so that one hundred ewes will not bring up more than fifty lambs; they are also by no means hardy, and the flesh is inferior. To atone for these bad qualities, the wool is superior to every other kind, and forms, indeed, the principal source of profit; the fleece is close, short, and abounding in yolk, weighing heavy, and is superior to all others in its felting properties.

"It is computed that not less than ten millions, or a moiety of the whole number of sheep kept in Spain, are migratory, and occupy no less than a quarter of the year in going and returning to their summer and winter pastures. These Transhumantes, as they are termed, leave their winter quarters in the south about the middle of April, and proceed slowly on their six weeks' journey. One division travels towards the east, and the other in a more westerly direction. During their journey they are shorn in large buildings, built expressly for the purpose, which are divided into two large compartments, with a smaller one adjoining. Those sheep which are to be sheared first are driven into the small hut as closely as possible, and there remain throughout the night, so as to occasion a considerable sweat, which softens the unctuous matter, and renders the shearing easier. No previous washing is employed, but in this manner a thousand are shorn in a day, there being a sufficient number of shearers in attendance for the purpose. This singular custom, which has existed for centuries, is protected by certain laws, which give to these sheep the right of pasturage on the common lands on their passage, and regulate other matters relating to it. The wool is divided into three different parcels, as it is taken from the back, rump, and thighs, and shoulders, or head, belly, and hocks, and these are respectively valued as superfine, fine, and waste. The wool is washed first in water at 120° Fahrenheit, and afterward in running brooks. It is stated that there are no less than fifty thousand shepherds employed in tending these sheep, which are generally divided into flocks of a thousand each. These shepherds are a singular race of men, sleeping on the ground while on their journey, and living in huts during the rest of the year, and existing on a spare diet, varied occasionally with some mutton from their flocks, which accident or disease may have afforded them.

"The sheep remain in their summer quarters till September, when they set out for their return. The rams are put to the ewes in July, so that the lambs are dropped soon after the flock arrives at their winter quarters.

"In these long and tiresome journeys, it cannot be otherwise than expected that great loss should be experienced from casualties and disease. A great mortality takes place, and no less than half the lambs are destroyed, in order that the others should have the advantage of a double number of nurses. The migratory system is more ancient than advantageous. It would, indeed, be far more profitable if the sheep were stationary, and the breed varied so as each to be bred on the most suitable pastures.

"The stationary sheep are termed Estantes, and consist partly of large sheep, and partly of Merinos, besides the mixed breeds; and it is found that the stationary Merinos do better than the migratory ones in every respect.

"For many centuries the Merino sheep were confined to Spain, and preserved with jealous care. Sweden appears to have been the first country which succeeded in procuring them; and in 1723 a small flock was imported from Spain, and there are now about seven hundred thousand in Sweden, but they are somewhat inferior to the original breed. In France many attempts have been made to cultivate them during the last century, but altogether with but little success. In Germany, however, the experiment has been eminently successful. The Elector of Saxony introduced the first flock in 1765, and about ten years afterward another small flock was brought to Austria; and in 1786 and 1802 they were introduced to the imperial domains of Holditch in Hungary, and Maunersdorf in Austria. Such is the origin of the German Merino, which has now spread so extensively over these vast countries. There appear to be now two distinct breeds, differing from each other both in appearance and the quality of the wool. First, the Infantado, or Negretti, having shorter legs and a stouter body than the others, and the head and neck comparatively short and broad; the nose short and somewhat turned up, and the body round. The wool, observes Mr. Carr, is often matted upon the neck, back, and thighs, and grows upon the head to the eyes, and upon the legs to the very feet. The grease in its fleece is almost pitchy, so as to render the washing difficult. This breed is descended from the sheep imported directly from Spain into Austria, while the other breed, called Escurial, are those which were first imported into Saxony. They have longer legs, with a long, spare neck and head, with very little wool on the latter; and a finer, shorter, and softer character in its fleece, but less in quantity than the other breed The fleece, in the Escurial, averages from one and a half to two pounds in ewes, and two to three pounds in rams and wethers; while in the Infantados it is from two and a quarter to three and a quarter in ewes, and from four to six pounds in rams and wethers.

"Many attempts have been made to amalgamate these breeds, but without success; the advantages of each can only be retained by preserving them pure.

"'These sheep,' observes Mr. Carr, a large owner in Germany, 'cannot thrive in a damp climate, and it is quite necessary that they should have a wide range of dry and hilly pasture of short and not over nutritious herbage. If allowed to feed on swampy or marshy ground, even once or twice, in autumn, *they are sure to die of liver complaint in the following spring.* If they are permitted to eat wet grass, or exposed frequently to rain, they disappear by hundreds with consumption. In these countries it is found that the higher bred the sheep is, especially the Escurial, the more tender. They are always housed at night, even in summer, except in the very finest weather, when they are sometimes folded in the distant fallows, but never taken to pasture till the dew is off the grass. In the winter they are kept within doors altogether, and are fed with a small quantity of sound hay, and every variety of straw, which has not suffered from wet, and which is varied at each feed; they pick it over carefully, eating the finer parts, and any grain that may have been left by the thrashers. Abundance of good water to drink, and rock-salt in their cribs, are indispensables.' By these means the Saxon sheep has been formed, which is more valuable in the fleece than the Merinos.

"Our notice of the sheep in other countries must be exceedingly brief. Along the western coast of France the traveller continually meets with the semblance of those noble animals which Edward IV. permitted to be annually sent to improve the breed of foreign sheep on the other side of the Channel. The wool is now about the same in value as that of our inferior Lincoln or Kentish. In Normandy is a larger and a coarser variety of the same breed. In the old province of Maine succeeds the old, unimproved, long, and thin-carcassed native French breed. In Bretagne and Gascony will be recognised the native short-wools, some of them exceedingly valuable; in Navarre, a mountain breed, with its *kempy* fleece; in the Lower and the Higher Pyrenees, the two essentially different breeds which countries so different, yet so near to each other, produce. On entering Rousillon some migratory breeds scarcely inferior to the Merinos are found, and also in Languedoc and Arles. The whole number of sheep in France is calculated at about 30,000,000. The royal Merinos are called *Rambouillets.*

"Notwithstanding the accounts given by some authors of the *Italian* sheep, and of the care bestowed on them, there are few deserving of notice except some Merinos. With the exception of a few of the valleys, the same may be said of the *Swiss*, and also of the *Savoy* sheep, but in *Piedmont* there has been from time immemorial a breed of sheep inferior only to the Merinos. In most of the *German States*, the Merino, the Saxon breed, is almost the only sheep that is cultivated. It is the same in Prussia, except that the sheep are somewhat diminished in size, while the wool retains all its value. The chief wealth of *Hungary* is derived from the cultivation of the Merino sheep. Of the two *Hanoverian* breeds, the larger one has almost disappeared; the smaller has been crossed with the Merinos, and yields a wool of some value for ordinary purposes. The *Dutch* and *Flemish* breeds are of English origin, although some of them have considerable resemblance to the Irish long-woolled breed. Their wool is used for the production of the coarser kinds of goods."

The following answers to queries are by Judge Buel, and peculiarly adapted to this season:

"What sheep are the most profitable? The Saxon and Spanish Merino for fleece; the South Down and new Leicester for mutton. The fleece would probably be the most desirable object in Tennessee and the West.

"What is the best time to move them? In September.

"What pasture bests suits them, and how many can be kept on an acre? Sheep want a dry pasture, and if hilly and stony, the better. Although they will *thrive* best upon good herbage, such as other farm stock like, they will *live* where other animals will starve. They bite close. An acre of good pasture will summer six sheep.

"How many should be kept together? what shelter do they require, and what food, in winter? The number in small enclosures, or in a yard, or in a shed, should not exceed 100: when in large pastures, it may exceed 100; sheds are only necessary to protect them from storms, and to keep them dry in winter. They want air and exercise. Sheep are kept upon hay and straw in winter; some add oats, or corn, or roots, either of which is serviceable in keeping them in good plight. One quart of grain may be given to a dozen sheep per day, beginning to feed with a less quantity. In Tennessee sheep will get much from the pastures in winter, where they should be permitted to range in dry weather.

"How is wool managed for exportation, the time of shearing, &c.? The wool is carefully rolled up, each fleece separate, and tied, and sent to market in bales like those used for cotton. Shearing is generally performed here in June, after the cold rains have subsided. It is considered bad policy to shear lambs the first season, as they want their fleece to protect them during our cold winters, and it is found that nothing is gained by early shearing. It is advisable to tag ewes in spring and autumn. Sheep enrich the land on which they run. A good shepherd and his dog can take care of 1000 to 1500 sheep, or more, and feed them in winter."

"This will be the proper place to speak of the *shearing* of the sheep, or the separation of the fleece from the animal. The time for this operation will vary much with the state of the animal, and of the season. After a cold winter, and the animal having been neglected, the sheep will be ready at an early period, for the old coat will be loosened and easily removed. The operation should never be commenced until the old wool has separated from the skin, and a new coat of wool is sprouting up. The coldness or warmth of the spring will also make a great difference. The usual time for shearing is about the middle of May, and the sheep-master will in a moment perceive when the fitting time is come. It is a bad practice to delay the shearing, for the old fleece will probably have separated, and the fly will have longer time to do mischief, and the growth of the new fleece will have been stinted, or a portion of it will be cut away by the shears.

"Custom has very properly required that the old fleece shall be cleansed before its removal, by washing the animal in some running stream. Two or three days are then allowed for the drying of the wool previous to its being shorn, the sheep being turned into a clean rick-yard, or field, or dry pasture, and remaining there until the fleece is dried, and that the new yolk, which is rapidly secreted, may penetrate through it, giving it a little additional weight and a peculiar softness. As soon as the sheep is shorn, the mark of the owner is placed upon it, consisting of lamp-black and tallow, with a small portion of tar, melted together. This will not be washed away by any rain, but may be removed by the application of soap and water.

"On the score of humanity, one custom must be decidedly protested against—the shearing of a flock of sheep before they are driven to the market in an early part of the spring. The farmer thinks that he shall get nearly or quite the same price for the sheep whether the wool is off or on. But does he find this to be the case? When the poor animals are shivering under the influence of the cold air, do they look so attractive? Do they handle well? Is there not an appearance of disease about them? Does not the rheum that hangs about the nostrils indicate the actual commencement of disease?

"Few rules can be laid down with regard to the rearing and feeding of sheep that will admit of anything like general application. A great deal depends on the kind of sheep, and the nature of the pasture and the food.

"Suppose the larger kind of sheep, and on arable ground. The ewes are generally ready to receive the ram at the beginning of October, and the duration of pregnancy is from about twenty-one to twenty-three weeks, bringing the period of parturition to nearly the beginning of March, at which time most of the lambs will be dropped. It is best to postpone the tupping till November, so that the lambs may be dropped in April, when there is grass. The ewes should be fed rather better than usual a short time previous to the male being introduced. Rams are fit to propagate their species in October and November of the second year, and that is also the proper period for the impregnation of the ewes. The ewe is, after impregnation, suffered to graze on the usual pasture, being supplied, as occasion may require, with extra food, and especially in cases of snow, until within five or six weeks of lambing, when turnips or roots are given to her, and continued from that time until the spring of grass renders them no longer necessary. The turnips are laid out for the ewes in the grass fields in certain quantities each day, but by no means so many as they would consume if permitted to feed without restriction, as it is considered to be most important that they should not be too fat when the lambing season approaches. The hogs and the fattening sheep of the previous year, now one year and a half old, are put upon the turnips whenever the pastures cease to improve their condition. The turnips required for the cattle, or the ewe flock, are then drawn off in alternate rows, in the proportion of one half, one third, or one fourth, as the convenience of the situation, the goodness of the crop, or the quality of the land may dictate. The remainder are consumed on the ground by the other sheep.

"As the period of parturition approaches, the attention of the shepherd should increase. There should be no *dogging* then, but the ewes should be driven to some sheltered enclosure, and there left as much as possible undisturbed. Should abortion take place with regard to any of them, although it does not spread through the flock as in cattle, yet the ewe should be immediately removed to another enclosure, and small doses of Epsom salts, with gentian and ginger, administered to her, no great quantity of nutritive food being allowed.

"The ewes should now be moved as near home as convenience will permit, in order that they may be under the immediate observation of the lamber. The operation of *clatting* (tagging), or the removal of the hair from under the tail and around the udder, should be effected on every long-woolled ewe, otherwise the lamb may be prevented from sucking by means of the dirt which often accumulates there, and the lamber may not be able at all times to ascertain what ewes have actually lambed. The clatting before the approach of winter is a useless, cruel, and dangerous operation.

"The period of lambing having actually commenced, the shepherd must be on the alert, yet not unnecessarily worrying or disturbing the ewes. The process of nature should be permitted quietly to take its course, unless the sufferings of the mother are unusually great, or the progress of the labour has been arrested during several hours, or eighteen or twenty hours or more have passed since the labour commenced."

"The following very useful observations, from an essay by Mr. Cleeve, in the first volume of the 'Journal of the Royal Agricultural Society of England,' are worthy of much consideration: 'The shepherd must not be led, by the appearance of uneasiness and pain, to interfere prematurely; he must watch the ewe closely, and so long as she rises at his approach, he may be assured that, whatever uneasiness she may exhibit, all is well. Much uneasiness is generally apparent; she will repeatedly lie down, and rise again with seeming distress. If this occurs when driving her to fold, he must be very cautious and gentle in urging her. These symptoms ought to be continued for two or three hours, or even more, before he feels imperatively called on to interfere, except the lamb is in such a position as to warrant fears of losing it. In cold weather particularly, the labour is likely to be protracted. Should the ewe appear exhausted, and gradually sinking under her labour, it will be right to give her some oatmeal gruel, with a little linseed, in the proportion of a spoonful of the latter to two of the former. When the ewe feels that she is unable of herself to expel the lamb, she will quietly submit to the shepherd's assistance. In giving her this assistance, his first duty is to ascertain whether the presentation is natural. The natural presentation is with the muzzle foremost, and a foot on each side of it. Should all be right in this respect, he must proceed to disengage the lamb, first very gently drawing down the legs, and with all possible tenderness smoothing and facilitating the passing of the head with his fingers, rather than forcibly extricating it, the particular attention of the shepherd being given to these points. This may be effected by passing the finger up the rectum, until he feels the back of the lamb's head, and then urging it forward at the same time that he gently pulls the legs. Sometimes the head is sufficiently advanced, but the legs are too backward. In this case the head must be gently pushed back, and the hand being well oiled, must be introduced into the vagina, and applied to the legs so as to place them in their natural position, equal with the head. Should the fore feet, on the other hand, protrude, they must in like manner be returned, and the same assistance given to advance the head. If the hinder quarters present themselves first, the hand must be applied to get hold of both the hind legs together, and draw them gently but firmly: the lamb may often be easily removed in this position. It is no uncommon occurrence to find the head of the lamb protruding, and much swollen; but still, by patience and gentle manipulation, it may often be gradually brought forward; or even nature, not unduly interfered with, will complete her work if the pelvis is not very much deformed. Should, however, the strength of the mother be rapidly wasting, the head may be taken away; and then, the operator pushing back the lamb, may introduce his hand, and laying hold of the fore legs, effect the delivery. It also often happens that the legs are thrust out to the shoulder, and from the throes of the ewe, it is not possible to replace them so as to get up the head of the lamb. By partially skinning the legs, you may disunite them from the shoulder-joint; there will then be room for the introduction of the hand, and by laying hold of the head you can deliver the ewe. A single season of practice will do more than volumes of writing to prepare the farmer for the preceding and some other cases of difficult labour. But let him bear in mind that, as a general rule, the fœtus should, if possible, be placed in its natural position previously to any attempt to extricate it by force. When force must be used, it should be as gentle as is consistent with the object of delivery. I need scarcely observe that the ewe must be the object of careful nursing and care, until she is completely restored.'

"*Abortion.*—Though not so common as in cows, this disease, as it may be termed, sometimes occurs very extensively, and becomes of serious consequence to the sheep-owner, disarranging all his plans, as well as occasioning a severe pecuniary loss. It may occur at all periods of pregnancy, but is most frequent when the ewe is about half gone. The causes of abortion are various: sudden fright, jumping over hedges or ditches, being worried with dogs, and the too free use of salt, have all been known to produce it; but that which causes it more than anything else is the unlimited use of turnips and succulent food. Many farmers may have, doubtless, been in the habit of permitting this with impunity, and would therefore be disposed to doubt the evil consequences of the practice; but it is not in every season that it is attended with the danger; but when vegetation has been abundant in the autumn, and the winter has been unusually wet, there is considerable probability of the ewes casting their lambs. Such was the case during the past spring in numerous instances in this locality, and several of which came under my own particular attention. One farmer had nearly a hundred aborted, and lost a good many of the ewes. They had been turned on a fine field of turnips, and subsisted entirely on them and water-meadow hay for some time previous to the commencement of the mischief, which began soon after Christmas, and continued for several weeks. Though the greater number of ewes recovered, yet they suffered much, and some died from inflammation of the womb, and others became paralyzed.

"The *symptoms* first manifested are dulness and refusal to feed; the ewe will be seen moping at a corner of the fold, and will be heard to bleat more than usual. To these succeed restlessness, and often trembling, with slight labour pains, and in the course of twelve hours abortion will have taken place. Sometimes the parts will be so relaxed, that the uterus or vagina will become inverted, and the expulsion of the placenta will precede that of the fœtus. In the flock before alluded to the lamb was almost universally dead, and often exceedingly offensive, and the abdomen was distended with a bloody, watery fluid, pointing out pretty clearly the nature and source of the disease.

"The *treatment* to be adopted is of two kinds, preventive and curative: the former, however, is the most important. In the first place, it is imprudent to turn ewes in lamb into turnips; they should have instead some dry pasture, and be well supplied with hay. If feed is short, the turnips may be drawn and given them on the ground in moderate quantities, or, which is better, cut up and mixed with chaff, or bruised corn in troughs. It is better that the condition of the ewes be in some degree impaired, than that so great a danger as abortion should be incurred. If this precaution has not been observed, and abortion should appear, what then is to be done? The flock should be removed from the turnips to a dry pasture, and supplied with the best hay on the farm; the aborted parts should be carefully buried, and the ewe removed from the rest; and, if possible, the same man that attends the flock should not touch or go near the abortion, for there is very considerable danger from infection. The ewe should be placed in a sheltered situation, but allowed plenty of fresh air, and the following medicine may be given with some nourishing gruel:

Epsom salts	½ ounce.
Tincture of opium . . .	1 drachm.
Powdered camphor . .	½ "

"The two latter medicines may be repeated the following day, but not the salts, unless the bowels are confined.

"The immediate cause of death in fatal cases is inflammation of the uterus or womb."

"If any of the newly-dropped lambs are weak, or scarcely able to stand, he must give them a little of the milk, which at these times he should always carry about him, or he must place them in some sheltered, warm place; in the course of a little while, the young one will probably be able to join its dam. The lambing field often presents at this period a strange spectacle. 'Some of the younger ewes, in the pain, and confusion, and fright of their first parturition, abandon their lambs. Many of them, when the udder begins to fill, will search out their offspring with unerring precision; others will search in vain for it in every part of the field with incessant and piteous bleating; others, again, will hang over their dead offspring, from which nothing can separate them, while a few, strangely forgetting that they are mothers, will graze unconcernedly with the rest of the flock.'

"The shepherd will often have not a little to do in order to reconcile some of the mothers to their twin offspring. The ewe will occasionally refuse to acknowledge one of the lambs. The shepherd will have to reconcile the little one to its unnatural parent, or to find a better mother for it. If the mothers obstinately refuse to do their duty, they must be folded by themselves until they are better disposed; and, on the other hand, if the little one is weak and perverse, he must be repeatedly forced to swallow a portion of her milk until he acknowledges the food which nature designed for him."

It is said that placing salt on the back of the lamb, and inducing the ewe to lick it, is a certain method of causing them to recognise their young.

Castration.—The following method is by Mr. Spooner:

"The earlier this operation is performed, the less likely is it to be followed by injurious effects. A favourable day should be selected, dry, but neither hot nor cold; and if the flock is considerable, it will be better to operate upon the lambs at different periods, by which they can all be operated on at pretty nearly the same age, than to wait and perform the whole at the same time: a fortnight is a very good age. It will also save trouble, and be quite as well, to dock them at the same time. There are different methods of performing the operation, but the following, which we have generally practised, is as expeditious, convenient, little painful, and satisfactory as any:

"The operator sits astride on a long stool, with one of the lamb's hind legs under each thigh, the fore legs and head being held by an assistant. With the finger and thumb of the left hand, he draws up the lower part of the scrotum or bag, and cuts off a portion of the skin with a sharp scalpel or knife. He then grasps the upper part of the scrotum, which forces the testicles forward, and with one incision separates the part which divides the testicles, sufficiently to cause them both to escape from the bag. He then places the iron clams on the cords above the testicles, and with a hot iron divides the cords, and the operation is completed. By removing a portion of the skin, though the wound is rather longer healing, there is less likelihood of matter collecting within the bag. A little lard may be smeared on the parts afterward, to keep off the fleas, &c. Before the operation is performed the bag should be examined, in order to find whether any rupture exists, in which case some of the intestines will have escaped into the scrotum. In such case, the operation must be performed in a more careful and difficult manner. Four small slips of wood, about four inches in length, must first be provided. Two sticks of elder cut in half will be most suitable; and it will be better if the pith is removed and the vacancy filled with some caustic. One end of each pair must be fastened together with waxed thread. The intestines should be gently forced up into the abdomen, at any rate as high as possible. An incision should then be carefully made over each testicle, and through the skin alone: the testicle, with its coverings, should then be pressed through the opening in the skin, which, being held back, the elder-sticks should be placed on the cord above the testicle; and one end having been previously united, the other should be brought together, and firmly tied by an assistant with waxed thread. The other testicle may then be operated on in a similar manner. Care must be taken that neither the skin nor any portion of the intestine be included in the wooden clams, and they must be pressed together as closely as possible.

"In the course of three or four days the lamb should be examined; and if the testicle has fallen off, or can be removed by the hand, the thread may be cut and the clams removed.

"In castrating full-grown lambs, it is better to take out each testicle separately, through an incision made into each compartment of the scrotum, and the same method may be adopted as is practised with the horse.

"*Docking.*—This simple operation is performed on most lambs at an early age, generally, and very properly, at the period of castration. In the Dorset and Somerset horned sheep, and a few others, it is, however, customary to loave the tails; but if diarrhœa should attack the lamb, as it is likely to do in some degree, the long tails harbour filth, and sometimes cause sores, on which the fly will deposite its eggs.

"The best method of performing the operation is to place the tail on a block of wood, and excise it with a sharp iron red hot, about four inches from the root. It may, however, be cut off without any bad effect."

"Unless the pasture on which the ewes are placed is very good, it will be advisable to continue the use of the turnips or roots. A moderate quantity may be given twice in the day, care being taken that the whole of one quantity shall be eaten before any more is placed before them. This is a better practice than hurdling off certain portions of the field for the sheep, unless the land is perfectly dry.

"A little hay will always be serviceable while the flock is fed on turnips. It corrects the occasional watery quality of the turnips, and the sheep usually thrive better than if they are fed either on hay or turnips alone. Bran and oats, with oil-cake, have been recommended for the ewes before weaning time; but this is an expensive measure, and its cost can hardly be repaid either by the ewe or the lamb.

"By the end of March or the beginning of April the turnips are generally nearly consumed, and the farmer is occasionally a little puzzled to find sufficient food for his flock. He should have had some plots of rye to support them for a while. Rye grass and clover are very serviceable. Swedish turnips that have been carefully stacked on dry straw will be most useful, for the Swedes, properly prepared and housed, will retain their nutritive quality until the flock can be conveniently supplied with other food. Ruta baga are always useful for spring food. The after-grass likewise furnishes plentiful and wholesome food for the lambs.

"At length comes the time for weaning. In a poor country it takes place before the lambs are much more than three months old. In a more plentiful one the lambs may be left until the fourth month is nearly or quite expired. If the pasture is good, and it is intended to sell the lambs in store condition, the weaning may be delayed until six months. Whichever time is selected, it is of essential consequence that the mothers and the dams should be placed so far apart that they cannot hear the bleatings of each other. The ewes should be somewhat carefully looked after, and if any of them refuse to eat, they should be caught, the state of the udder ascertained, and proper measures adopted.

"The lambs should not be put on too stimulating food. The pasture should be fresh and sweet, but not luxuriant. It should be sufficient to maintain and somewhat increase their condition, but not to produce any dangerous determination of blood to any part. In the Northern and Eastern States it will be advisable to house sheep in large barns during winter.

"*The Diseases of Sheep.*—The rapid progress which the veterinary art has lately made has thrown great light on the maladies to which the sheep is liable, and the mode of preventing or removing them.

"Commencing with the muzzle and head, there is a disease, or rather annoyance, to which sheep are exposed by the persecution of a fly, the *Œstrus ovis*, or *gadfly* of the sheep. At a period between May and July this fly is perseveringly endeavouring to lay its eggs on the inner margin of the nostril of the sheep, whence, hatched by the warmth and moisture of the situation, and assuming its larva form, it crawls into the nostril in order to reach the frontal sinus, or cavities in the skull bone. Instinctively alarmed by the buzzing of the fly, or the motions of the larvæ, the sheep congregate with their heads in the centre, pawing continually with their feet, and expressing their dislike and fear in every possible way. It remains in the sinus a certain period, until it has attained its full growth, when it endeavours to escape, in order to undergo another transformation. It escapes from the nostril, burrows in the earth for a while, assumes its pupa state, undergoes its final change, and assumes the form of a fly, and then becoming impregnated, seeks again the nostril of the sheep. All that can be done with regard to this nuisance is to destroy the flies, which are generally to be seen on the walls or pales in the neighbourhood of the flock, and which the shepherd, or shepherd's boy, should be taught to recognise.

"Another parasite is a species of hydatid, the *Cænurus*, or *Hydatis polycephalus cerebralis*. It has the appearance of a bladder, sometimes filled with pellucid water, or, occasionally, with myriads of minute worms, or smaller hydatids. Its residence is the brain, either beneath the inner membrane of the brain, or in the fissure between its two hemispheres. The origin of it is not clear, except that it is connected with bad management, being scarcely known in upland pastures, or in grounds that have been well drained. As the parasite grows, it presses upon the neighbouring substance of the brain, and interferes with the discharge of its functions. There is an aberration of intellect; the sheep is frightened at any trifling or imaginary object; he separates himself from his companions; he commences a strange rotatory motion even while he grazes, with the head always turned towards the same side. This is the characteristic symptom, and as soon as it is perceived the animal should be destroyed, for there is no certain cure, and many of the operations that some persons have described are cruel and inefficient. The duty of the farmer is to destroy the *sturdied sheep* as soon as the disease is ascertained, however poor it may be in condition."

It may be well to remark, that when the hydatid is situated near the bone, and especially in the forehead, between and above the eyes, the skull becomes soft at the place, and this being discovered, a cure has sometimes been effected by cutting downward through the soft bone, so as to reach the hydatid; if this is cut through, it frequently dries; and should there be no more, a cure occurs. The puncture should not reach to the brain; half an inch is enough.

"A somewhat similar disease, but with which the hydatid has nothing to do, is *Hydrocephalus*, or *water in the head*, generally indicated by a little enlargement of the skull, a disinclination to move, a slight staggering in the walk, a stupidity of look, and a rapid loss of condition. This disease seldom admits of cure or palliation. If any amendment can be effected, it will be by the administration of good food, tonic medicine, and gentle aperients. When water in the head is an occasional visitant in a flock of sheep, there is something wrong in the land, or its management, or in the nature of the food, or the character of the sheep.

"Another species of pressure on the brain is of too frequent occurrence—*Apoplexy*. A flock of sheep shall be in apparently as good and fine condition as the farmer can desire. They have for a considerable period grazed on the most luxuriant pasture, and are apparently in the highest state of health. By and by, one or more of them is, without any previously observed change, suddenly taken ill. He staggers, is unconscious, falls, and dies, and perhaps within a quarter of an hour from the first attack. With regard to how many over-fattened sheep is this the case? The owners, taking them to some cattle-show, say that they died of inflammation. Inflammation had nothing to do with it. The sheep had been brought to the highest and most dangerous state of condition. Every vessel was overloaded with blood, and then some trifling exertion being required, or the animal being a little disturbed, the nervous functions were suspended, and the vital current suddenly arrested. Very few persons have gone into a cattle-show without being painfully struck with the evident distress exhibited by some of the over-gorged animals.

"If there is time for resorting to curative means, the jugular vein should be opened, and aperient medicine administered.

"*Inflammation of the Brain* is a frequent consequence of this strange over-feeding. It is ushered in by dulness and disinclination to move; but presently the eye brightens, and the animal attacks everything within his reach. If it can be managed, the same treatment must be adopted —bleeding, physic, and low feeding.

"*Locked Jaw* is not an unfrequent disease among sheep. It commences with an involuntary spasmodic motion of the head, accompanied by grinding of the teeth; but the latter symptom is presently succeeded by fixedness of the jaws. The disease often runs its course in a little more than twelve hours. The principal cause is cold and wet. After an unusually cold night, it is not uncommon to find many ewes that have lately lambed, and many lambs recently dropped, dead and stiffened. It sometimes occurs after castration, and at weaning time. Bleeding, aperient medicine, an opiate given an hour after the physic, and also a warm bath, are among the most likely means of cure.

"*Epilepsy* is a not unfrequent disease among young sheep which are exposed too much to cold, or dismissed from the fold too soon in the morning. Care and nursing will sometimes recover them, or a little exercise forced upon the patient.

"*Palsy.*—The appearance of this disease is mostly confined to the ewe and lamb at weaning time, or when they are left at night in a bleak and exposed situation. The vital heat is abstracted by the cold bed on which they lie, and the cold air around them, and there follows a compound of rheumatism and palsy, the latter predominant and most obstinate. In the majority of cases they will never regain their former condition or value, but continue a disgraceful exhibition of the carelessness and inhumanity of the owner. It is dreadful to think how many animals in some districts are thus destroyed. No little art and kind treatment are in some cases requisite in order to recover these neglected and abused creatures. Warm gruel or milk, and a moderate degree of warmth, are the chief restoratives that can at first with safety be applied. A little ginger and spirit of nitrous æther may be added to the gruel when the patient begins to recover.

"*Rabies.*—The rabid dog seems to have an irresistible propensity to worry sheep, and the poison is as fatal in this as in any other animal. There are cases on record in which from twenty to thirty have been bitten by the same dog, and all have died. If it can be proved that the flock has been attacked by a mad dog, every sheep should be most carefully examined, and if the slightest wound is found upon him, he should be destroyed. When the disease has broken out in the flock, no sheep that has exhibited the slightest trace of it should be used for human food.

"There is no cure for rabies, and he will incur fruitless expense who has recourse to any pretended nostrum for this purpose.

"*Ophthalmia* is a very frequent disease among sheep. The old people used to say that the animal had disturbed a lark's nest, and that the lark had spurred him blind. If any inflammation of the eye is detected, that organ should be frequently bathed with a weak solution of Goulard's lotion, to which a few drops of laudanum have been added. It is sometimes difficult to get rid of this affection, and cataract and permanent blindness will ensue. The Ettrick shepherd says that 'a friend will generally attach itself to the sufferer, waiting on it with the most tender assiduity, and by its bleating calling it from danger and from going astray.'

"*Hoove* is a morbid distention of the paunch with food, and the extrication of gas from that food. An account has been given of this disorder in the article *Ox*, so that every purpose will be answered by referring to it. The same may be said of all the diseases of the digestive organs. Their structure is the same in cattle and in sheep; and the causes and appearances and treatment of the diseases are the same.

"There is, however, a disease of the liver—*the Rot*—far more frequently occurring in sheep than in cattle, and bearing a peculiar and more destructive character.

"In the very earliest stage alone does it admit of cure. The decisive symptom, at that time, is a yellow colour of the eye, that surrounds the pupil and the small veins of it, and particularly the corner of the eye, which is filled with a yellow serous fluid, and not with blood. There is no other apparent morbid appearance until it is too late to struggle with the malady; on the contrary, the sheep, although perhaps a little duller than usual, has an evident propensity to fatten.

"The rot is a disease of the liver, attended by inflammation of that organ, and the vessels of it contain fasciolæ (*flukes*). The flukes are probably more the effect than the cause of the disease. They aggravate the disease by perpetuating a state of irritability and disorganization. The rot is evidently connected with the state of the pasture. It is precisely the same as marsh fever in men, originating from the poisonous vapours of marshes. It is confined either to wet seasons or to the feeding on ground that is moist and marshy. In the same farm there are fields on which no sheep can be turned without getting the rot, and there are others that never give the rot. After long-continued rains it is almost sure to appear. The disease may be communicated with extraordinary rapidity. A flock of sheep was halted by the side of a pond for the purpose of drinking; the time which they remained there was not more than a quarter of an hour, yet two hundred of them eventually died rotten. In the treatment of the rot little that is satisfactory can be done. Some sheep have recovered, but the decided majority perish in despite of every effort. The patients, however, may, as giving them a little chance, be moved to the driest and soundest pastures; they may undergo a regular course of aperient medicine. Mercurial friction may also be used, but, above all, plenty of salt should be placed within the animals' reach, and given to them in the way of medicine. Doses of calomel may be given in the early stages.

"In the way of prevention, the farmer may do much: he may drain the most suspicious parts of his farm. No money would be more profitably expended than in accomplishing this. Some of the little swampy spots which disgrace the appearance of his farm, possibly lie at the root of the evil.

"*Red-water*, or the effusion of a bloody serous fluid in the cavity of the abdomen, is a frequent and very fatal disease among sheep. The cause of it is a sudden change from one pasture to another of almost opposite quality, or the moving of the flock from a dry and warm to a damp and cold situation. It is most destructive to lambs if exposed to a hard frost, or suffered to lie on a damp and cold soil. The sheep will separate himself from the rest of the flock; he will evince a great deal of pain, by rolling about and frequently lying down, and immediately getting up again; and sometimes he dies in less than twenty-four hours from the first attack. The belly will be found swelled and filled with the red water, or serous fluid tinged with blood, from which the disease derives its name. The treatment should consist of mild aperients, with gentian and ginger, and a liberal allowance of hay and corn. Inflammation of the coats of the intestines (*enteritis*) would not always be readily distinguished from the last disease, except that there is more stamping on the ground and striking the belly with the hind legs, and occasional lying on the back. The principal causes of enteritis are improper food, or an excess of that which is healthful, or exposure to cold and wet. Here, also, bleeding is imperatively required, but the purgative should not consist of anything stronger than sulphur. *Diarrhœa* is a very prevalent disease among lambs, and especially after a change of diet or of situation. When it is not violent, and does not seem to be attended by colic, a little absorbent and astringent medicine, with a few grains of opium, may be administered. The diarrhœa of sheep may be similarly treated; but when the disease is assuming the character of *dysentery*, when the discharge is more frequent and copious, and mingled with mucus, a larger quantity of this medicine should be given, and some blood abstracted if there is any degree of fever."

Costiveness, or *stretches*, is attended with loss of appetite. The animal also frequently lies down and stretches itself: two table-spoonfuls of castor oil or one ounce of salts will remedy it. The disease is said to arise from want of green food. *Braxy* appears to be an inflammation of the stomach; the sheep refuses food, is costive, drinks often, mouth parched, eyes red, belly swollen and tender. Bleed, and give febrifuge medicines; place in the house, and, after a few days, give aperient medicines.

"The diseases of the *respiratory organs* are often of a serious character. During the greater part of the winter the nostrils will sometimes be filled with mucus, and the sheep is compelled to stop for a moment at every second or third bite, and snort violently, and stand with his muzzle extended and labouring for breath. If his general health does not seem to be affected, this *nasal gleet* will all pass away as the spring approaches. If, however, any of the flock should now appear to be losing flesh and strength, it is too probable that *consumption* is at hand. The only chance of saving or doing them any good will be to place them in some comfortable pasture, letting them have salt within their reach, and giving them the hydriodate of potash, in doses gradually increasing from three grains to twelve, morning and night.

"Lambs, when too early and too much exposed, are subject to diseases of the upper air passages (*laryngitis* and *bronchitis*), the one attended by a ringing cough, and the other by one of a more wheezing sound. Bleeding will always be necessary for the first, with aperient medicine. A mild purgative will usually suffice for the second, or, possibly, an ounce or an ounce and a half of common salt may be given dissolved in six ounces of lime-water.

"*Inflammation of the lungs*, recognised by difficulty of breathing, heaving at the flanks, and distressing cough, is a disease of frequent occurrence in sheep. It speedily runs its course, and the lungs are found to be one disorganized mass. Bleeding and purging are indispensable; but as soon as the violent symptoms seem to remit, tonics, composed of gentian and spirit of nitrous æther, must follow.

"*Epidemics.*—Sheep are not so liable to the attack of these diseases as horses and cattle. Sometimes, however, sheep suffer from epidemic diseases very seriously. They have cough, and discharge from the nose and eyes. The appetite ceases. Those that are affected by the disease separate themselves from the rest of the flock; they continually lie down, and many of them die. They exhibit, after death, inflammation through all the contents of the chest and abdomen, with effusion into the cavities of both. The disease is most rapid in its course. The shepherd may leave his flock in the morning, free, apparently, from any immediate danger, and when he returns in the afternoon he will find two or three of them dead. Epsom salts with nitre may be given. Blood should be abstracted if the case seems to require it; and the medicine should be repeated sufficiently often to keep the bowels gently open. If the purging becomes considerable, a little starch, with chalk and cinnamon, may be serviceable. Those that will eat should be foddered with good hay, and the others forced with gruel, being kept dry and comfortable, with plenty of clean straw under them. The detached horn should be pared from the feet where there was any separation, and the parts washed with a solution of blue vitriol, and then smeared over with melted tar. The mouth and tongue, on which there are generally some ulcers, should be dressed with a strong solution of alum in water. Under this treatment most of the patients will probably recover.

"*Garget.*—Inflammation of the udder is more frequent in the ewe than in the cow. The udder should be well fomented with warm water, and then, if there are no large knots or kernels, she should be returned to her lamb, whose knocking about of the udder will generally be productive of good rather than harm. If, however, she refuses the lamb, a drachm of camphor and mercurial ointment may be well incorporated with an ounce of elder ointment, and a little of it well rubbed into the udder every morning and night. If the udder should still continue to enlarge, a free incision must be made into that part where the swellings are largest. A weak solution of chloride of lime should then be applied, and when the putrid smell is gone, the friar's balsam should be used. In a few days the wound will generally be healed, and the lamb may be returned to its mother.

"*Diseases of the Feet.*—There is a small opening at the bifurcation of the pasterns, which leads to a canal running down the inner face of each to the commencement of the hoof. The function of this canal is a matter of doubt; but dirt or gravel, or other foreign bodies, sometimes get into these canals, and produce considerable pain, inflammation, and ulceration. The treatment consists in the extraction of any of those extraneous substances that can be got at, and the fomenting and poulticing, or scarifying the parts, or effecting incisions into the canal, and applying a caustic or a balsam, as the case may require."

Foot-rot arises from wet pastures. It first produces lameness, originating in the softening of the crust of the foot; ulcerations appear, and, finally, the animal is unable to move, and dies.

"The treatment of foot-rot essentially consists in paring away all loose and detached horn. This is the corner-stone of skilful and successful practice. All fungous granulations must either be cut away, or destroyed by the muriate of antimony, and the foot well washed with a solution of chloride of lime. The muriate of antimony must then be lightly applied over the whole of the denuded surface. This must be repeated daily, until the whole of the foot is covered with new horn. The diseased sheep must not be permitted to join his companions until the cure is complete; for it is a sadly infectious disease, and may easily spread through the whole flock."

Fouls is an irritation and suppuration of the gland in the cleft of the hoof. It is easily remedied by applying warm tar. It is not contagious.

"*The Scab* is a very troublesome disease, common in the spring and summer. The sheep is continually scratching himself with his feet, tearing off the wool, and violently rubbing himself against every protruding substance. The disease first appears in the form of minute pustules; but several of these unite, and form a scab. The health of the sheep becomes rapidly affected under this disease, and some of them pine away and die. It is a very infectious disease; for every place against which the sheep can rub himself becomes tainted with the poison. The sheep must be housed, and shorn as closely as possible, and then well washed with warm water. An ointment composed of one part of mercurial ointment and seven of lard, or sulphur and lard, must then be procured, and such a quantity of it as the diseased parts seem to require rubbed in on every second day. Every place in the field and in the fold against which he can possibly have rubbed himself must be well cleaned and painted before he is permitted to return. The cause of scab consists in the presence of a minute insect or tick (*Acarus*), which may be conveyed from one sheep to another when an infected sheep comes in contact with a sound one; or it may be left on the rubbing-post, and entangled in the wool of the next animal that comes in contact with it; or it may be the product, and is too often so, of disease of the part. It is of spontaneous origin, as well as the product of contagion, and is called into existence by the derangements which our neglect, or accident, or disease has made in the skin. This is a view of the case that should never be forgotten by the sheep-owner.

"*Lice* and *Ticks* will be best got rid of by the application of the mercurial ointment just recommended, or dipping the sheep in a decoction of tobacco.

"*The Fly*.—Several species of fly frequently deposite their ova on the wool of the sheep. If there are any sore places, they are selected for the habitation of the larvæ. The head, as the most exposed part, is the one oftenest attacked, and the sheep are sadly tormented by the fly and the larvæ. The best preservative or cure is the application of a plaster composed of a pound of pitch and a quarter of an ounce of bees' wax, spread on soft leather or linen. The attack may, however, be generally prevented by the application of a small quantity of spirit of tar to the head, or any bare or sore part. Two or three applications of this will be sufficient for the whole of the summer, and not a fly will approach a sheep thus guarded."

For medicines and their doses, see *Pharmacopœia*.

SHEEP-FOLD. A yard for sheep to be gathered into in cold weather or during night. It should be well littered, and in a dry situation. Sheds of slabs may be placed around, or facing the south, so as to afford them shelter from cold. Shelter and warmth during winter effect a great saving, even as much as one half of the food.

SHEEP-PENS. Enclosures made by hurdles. They should be situated on dry places. They are convenient for sorting and examining the animals, separating the sickly and lambing, &c.

SHEEP, PERUVIAN. The alpaca, or llama. See *Alpaca*.

SHEEP'S SORREL. *Rumex acetosella*. A small acid weed, growing in thin, poor soils.

SHELLER, CORN. A machine for removing the grain from the cob. There are innumerable patents for corn shellers. The machines are of two classes, either for shelling one or two ears, or acting on a large quantity. The former usually consists of a wheel of cast iron, roughened over the whole surface by knobs, which is rotated against the ear placed in a spring case; by this means, the knobs, grating against the ear, tear off the seeds, and the cob is gradually pushed out of the case below: the case is connected with a hopper. For larger purposes, a cylinder is roughened and made to rasp against the ears. *F. N. Smith's* corn sheller seems to be the most effective of the latter kind; it is made by Hanna and Peaslee, Valatie, New-York: they will shell and separate the cobs of upward of 100 bushels in the hour. Price $40.

SHELL LIME. Lime procured from burning shells. If well made, it is excellent for agricultural purposes, as it contains nearly two per cent. of bone earth, and is free from caustic magnesia. The term lime shells is used by many writers, from the lumps of fresh-burned lime before slacking.

SHELL MARL. This is very rich in the remains of shells: it is the best kind, and may often be profitably burned for lime.

SHELLS. When burned, they form the best lime. In the pounded state they resemble the best marls, but the shells of crabs, lobsters, and animals of that kind (*Crustaceans*) are rich in animal matter and bone earth, containing from 30 to 40 per cent. of the former, and 12 to 14 of the latter, the remainder being carbonate of lime; it would be a great loss to burn them: but oyster, and other similar shells, contain very little animal matter.

SHELL SAND. The shelly sand of the seashore, or ancient sea beaches, is extensively employed in France and Ireland as a manure, or, rather, amendment: fifty or more loads are put to the acre of stiffish soil. It is identical with sandy marl in its effects, but somewhat superior, inasmuch as it often contains a small amount of animal and saline matters. Its value is, like that of all marls, measured by the proportion of shells it contains.

SHEPHERD. The man who tends sheep; he should be of a kind disposition, as sheep are wayward and obstinate; he should be well acquainted with their diseases, and take an interest in his charge. Many diseases of sheep are so sudden and fatal, that unless they are constantly under the eye of a well-informed and kind person, numbers will die annually.

SHERDS. Fragments of garden pots, used to under-drain the soil of boxes, pots, &c.

SHIELDS. "In botany, little coloured cups or lines with a hard disk, surrounded by a rim, and containing the sporules, or seeds of lichens."

SHIFT OF CROPS. Rotations.

SHIM. "A tool of the tillage kind, used in breaking down and reducing the more stiff and heavy sorts of land, as well as cutting up and clearing them from weeds. They are made of different forms and constructions, to suit different purposes."—(*Johnson.*)

SHINGLE. A coarse, sea-shore gravel.

SHINGLES. "In architecture, small slabs of wood, or quartered boards, used instead of slates or tiles for covering roofs. They are sawn to a certain scantling, or, rather, cleft to about an inch thick at one end, and shaped like wedges by machines or the drawing-knife, four or five inches broad and eight or nine inches long." The cedar yields the finest shingles. Shingle roofs should always have a very considerable pitch to let off water.

SHOCKS. Stooks, or hattocks, horse-heads; assemblages of sheaves, from six to twelve, independently of the two or four hood, or roof sheaves. Also, an accumulation of hay of 100 to 300 pounds.

SHORE. A piece of timber which props up a wall.

SHORT HORNS. The breed of cattle with short horns, considerably improved, and now much celebrated in the United States under the name of Durhams.

SHOVEL. The wide curved spade for casting earth, and not digging.

SHREW. *Soricidæ.* A family of small, insectivorous, rodent quadrupeds: they resemble the moles, and, on the other hand, mice, and live, for the most part, in excavations made in the soil.

SHRUB. "A small, low, dwarfish tree, which, instead of one single stem, puts forth from the same root several sets or stems." A collection of these, tastefully arranged, is a shrubbery.

SHUCK. The husk, or collection of involucra about the corn ear. Shucks are much esteemed for fodder, being very superior to straw and corn fodder. When cut into shreds, they make a good material for mattrasses. This word is also used for *shock.*

SHY. Starting aside, in horses: the result of fear, produced by strange objects.

SIALAGOGES. Drugs which produce salivation, or an increased flow of saliva.

SICKLE. The reaping hook. See *Harvest*.

SIENITE, SYENITE. A gray granite; Boston granite: it contains hornblend in the place of mica.

SILEX. SILICIC ACID. Pure sand, rock crystal. This familiar body is an acid, and consists of 1 equivalent of silicium (22·22), a body resembling in appearance charcoal, and 3 equivalents of oxygen, 46·22. In the cold it is inactive, but at a white heat it forms an exceedingly active acid, combining with bases, and displacing most other acids, except the phosphoric and boracic. The silicates are nearly all insoluble in pure water; glass and common earthen-ware are specimens of silicates, but they gradually decay in the presence of acids, and of carbonic acid and water. But the compounds of silicic acid, with two or three times its weight of carbonate of potash or soda, are soluble silicates, and have been recommended as manures for the cerealia, which always contain a large amount of silicic acid in their stems, leaves, and husks. Most of the minerals and rocks of the earth are silicates, this acid forming from one quarter to one third of its entire solid mass.

Soluble and other silicates are formed by fusing together sand and the desired chemical body, usually in the state of carbonate, in a black-lead crucible, at a full red heat.

The stores of potash, soda, lime, and magnesia in the soil which supply plants with saline matters, are often in the form of silicates; these are slowly decomposed under the influence of the carbonic acid of the air, or from decaying vegetable matter, which converts them into soluble carbonates, whereby they gain access to the plant.

SILICATES. Salts containing silicic acid; they are usually flinty and insoluble: slate, feldspar, and granite are specimens.

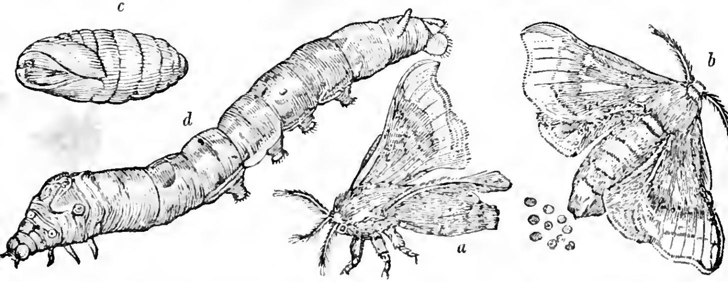
SILICULA. "A fruit exactly similar to that called a siliqua, except that it is shorter, and contains fewer seeds. It is never more than four times as long as broad, and usually much shorter."

SILIQUA, SILIQUE. "A one or two celled, many-seeded, linear fruit, dehiscent by two valves separating from a septum; the seeds are attached to two placentæ adhering to the septum, and opposite to the lobes of the stigma. The fruit of the mustard is an example."

SILIQUOSE PLANTS. Improperly applied to leguminous plants, but properly to the cruciferous family.

SILK. On this subject much has been written and said of late; there is no question that by judicious management a good profit can be made by raising the worms.

The silk worm is the larva or caterpillar of the *Phalæna bombyx* (*Bombyx mori*, Lin.); *a* represents the male, and *b* the female moths; *c*, the grub, or chrysalis. The eggs are hatched in April or May, but may be kept back until the end of May by placing them in a cool, dry place. The eggs should be hatched in parcels, and not



altogether, as by this means the labour is increased, and casualties, as frost, may deprive the grower of his whole crop. The natural food is the mulberry leaf, which should be fed so as to suit the age of the worm, the youngest worms receiving the young leaves, and the full leaves being fed to the large worms. In the beginning, if mulberry leaves are scarce, *lettuces* will answer; but these do not answer for the whole season, but only at first. Mulberry leaves of the previous year, carefully dried of a green colour, and moistened for use, will also answer for the early crop of worms. The worms grow about six weeks, but this depends on the variety and state of the weather: they moult, or change their skin, four times in the season. Having completed their growth (*Fig.*, *d*), they become restless, and retire to crannies, branches, or the corners of their apartments to spin a cocoon; here the worm is changed into a grub, or chrysalis; this, in some 15 days, becomes changed to a moth, which eats its way through the cocoon. The perfect insects live but two or three days, the eggs being laid in this time: the eggs are received on paper or cloth, and dried before being put away.

The silk grower proceeds to obtain the silk fibre from the cocoon before these changes are completed, and destroys the grub by alcohol, or boiling water. The cocoons are plunged in hot water, and examined to find the end of the silk fibre; twelve or more of these are now brought together, and made fast to the reeling arrangement. The best reel is called the *Piedmont* reel, but this is to be tended by experienced persons, and is best set up at proper filatures, of which there are many, especially at the manufactories. Mr. *Van Epps* has established one in New-York, and issued the following judicious *suggestions to silk growers:*

"The nursery for worms should be furnished with a stove for raising the temperature in damp, cold weather. Artificial heat may frequently be employed to advantage (particularly in New-England), previously to the third moulting, while the worms require but little space and air.

"We would here caution growers against noise; every preparation requiring pounding or jarring should be attended to before the worms are hatched, that everything in and around the building may be pefectly quiet throughout the whole feeding.

"The feeding frames which we use, and prefer to any other fixtures we have seen, are very simple, combining all the advantages of 'Gill's ventilating cradle,' with none of its disadvantages, saving much time and some expense in their construction, besides being a sure defence against mice, rats, ants, and other enemies of the silk-worm. Should any of our readers be disposed to adopt our plans, the following description will be sufficient:

"In the first place, attach the pieces of timber designed for suspending the frames to the rafters, allowing them to come down to within two feet of the ground. These should be about seven or eight feet apart at the top, and four or five at the bottom, which will cause the frame to enlarge in nearly the same proportion with the worms, and thus prevent their becoming too much crowded: this is the chief excellence (we think) of Gill's cradle. Cross pieces should be fastened at the lower ends of the upright timbers, on which to lay boards to receive the worms from the nursery. About two inches above these boards should be placed sticks, one inch square, resting on pieces running lengthwise at the sides; these, at first, should be six inches apart (after a few days' feeding, one half can be drawn out), and in feeding, the branches should be laid between them, until they are filled up to the top, when they should be laid across. After two or three days' feeding, the boards and dry branches should be removed from under the worms, and they left to feed on the branches above. If care is taken to feed no more than is needed, the brush will remain very open, allowing all the pieces of leaves and the excrements from the worms to fall directly through to the ground, from which they should be often swept out, furnishing a free circulation of air from beneath. At the sides and ends of these frames it is necessary to have something to keep the branches in order, and prevent the worms from falling off; these may be made of narrow boards or lath; between these and the brush most of the cocoons will be placed, as it secures the worms from the light, and furnishes them with places for fastening their floss whenever they have finished eating and are ready to spin. These directions, of course, are applicable only where *branch feeding* is practised. Cocoons should not be gathered until dried, that is, in six or seven days from the time the worms began to spin. Those designed for eggs should be selected first, taking such as have been spun by the most healthy worms. These should be closely flossed, and spread out thin on the shelves in the nursery.

"We now come to the destruction of the chrysalis, and the curing of the cocoons, upon which the value of the silk must depend. We cannot dwell upon this point with too much care. We have received at our filature cocoons that had been almost ruined by the means used for stifling the chrysalis. Our standing offer is from $2 50 to $3 50 per bushel; yet we have had cocoons sent us which would not pay the expenses of reeling and transportation. Among the many means resorted to for this purpose, *alcohol* is doubtless *the best*, as it not only destroys the chrysalis, but leaves the fibre of the cocoon in fine order for reeling, and is supposed by some actually to add to its original beauty. Not more than half a pint (some use only a gill, others a pint) is needed for a bushel of cocoons. They should be placed for this purpose in a tight box; first a layer of cocoons (very thin), then a slight sprinkling with alcohol, and so on till the box is filled, which should then be nailed up tight. After remaining in the box about 24 hours, they should be removed and spread out for drying, which will take several days, even in very warm weather. If the chrysales are not entirely dry, they undergo a putrefaction, which frequently injures the silk, and renders them very offensive to the reeler. Persons designing to send their cocoons to our filature are requested to adopt the above method, and as soon as dried the cocoons should be forwarded, as it is exceedingly hazardous purchasing when they have been lying for some months and become very dry."

The following important facts are gleaned from the correspondence of various silk conventions:

1st. That of the varieties of mulberry, the Canton is the most valuable, then the multicaulis; the broosa is as early, and larger leaved than the white. The worms are fed with small branches.

2d. It is best to feed in open sheds, which may be of tarred canvass, and temporary. The cradles of Mr. Gill, or those just described by Mr. Van Epps, are the best places to feed them on: shelves should not be set up. The greatest attention should be had to cleanliness.

3d. There should be no attempt to raise two crops the same year. Early hatching is altogether to be preferred to late.

4th. The best varieties are the peanuts; they are hardiest, mature early, and produce a cocoon that reels well: the sulphur and white are also esteemed kinds. The eggs are hatched from the papers on which they were laid in seven to ten days after being brought out, and at a temperature of 70° Fahrenheit: the rooms should be kept at that heat.

5th. It is best to sell the cocoons at $3 or $3 50 the bushel than to attempt reeling without experience.

6th. On an average, 3500 worms will yield a bushel of cocoons, which reels into from one pound to 20 ounces, and sells at upward of $5 the pound. The cost of raising is $2.

According to Dr. Smith, each worm consumes an ounce of leaf; 120 females yield an ounce of eggs, containing 39,000 eggs.

7th. The nature and quality of the staple obtained are thus described by an able weaver and judge of silk from Spitalfields:

"I am qualified to affirm, from various experiments I have tried, that the silk is superior to any I have seen from Italy, China, France, Piedmont, or Valencia, where the worms are fed upon multicaulis, or Italian; its brilliancy, strength, and scent are superior. I am aware that an exposure to the saline air, in the passage across the ocean, may be the cause of the loss of fragrance to imported silk; but the *brilliancy* is peculiar to American silk, if reeled in a proper manner, with cleanliness.

"I am confident that the mammoth sulphur worm is the pure Fossam brown. To try this, I had about three pounds of silk reeled, and enclosed it in an air-tight box for three weeks. When I took it out it had the fragrance of the Fossam brown stronger than any that I ever smelled in England, which convinced me that the mammoth sulphur is the identical silk which is always from five to eight shillings per pound higher than ordinary silk. The mammoth white and the pea-nut white are Novi, and superior to any I have seen in England. The yellow, or orange, I cannot, satisfactorily to my own mind, yet define, but am trying experiments in order to ascertain. I am strongly persuaded it is a Bergam; should this be the case, it will prove a great acquisition to manufacturers of silk velvet. Some have supposed the pea-nut white is the Piedmont, but they are mistaken; the Piedmont cocoon is lily-white, very diminutive, with a sharp point."

Mr. Young, a dyer of Detroit, also remarks, concerning the cleansing of silk: "Most people clean the silk with soft soap, destroying the native gloss in freeing it of its gum, owing to the vegetable alkali the soap contains, the silk being animal substance; it will completely dissolve wool, if applied strong enough, forming a soap of itself. Many dyers use nothing but the best white soap; being made from mineral alkali, soda acts gently on animal substances; nor does it give that yellow tinge the vegetable alkali produces. It is even necessary to bleach silk for certain shades, to give them a clear bloom. About 25 pounds good white soap, dissolved in sufficient clean, soft water, for 100 pounds silk; put the silk loosely in their bags; boil gently, say 2½ hours; cool and wash well in a running stream: beat occasionally, to free it from all impurity. This I know by practice."

We shall conclude by offering several letters from the ablest raisers of silk, addressed to the convention held at the American Institute in 1843:

Mr. Gill's Letter.

"Mt. Pleasant, Jefferson Co., Ohio.

"1. I have fed worms for five years past: results various, owing to the various fixtures used, and experiments tried, attention or neglect of the feeder. *I never had a lot of worms diseased, or die, if from a healthy stock of well-kept eggs, without being able to trace the cause, which was always local, and easily remedied.*

"2. I have used both one and two story buildings, built of brick and of wood; have used stoves, and also fireplaces with chimneys: prefer fireplaces on account of their drawing off impure air. I think artificial heat beneficial in cold, damp weather, especially when worms are spinning. My cocooneries are ventilated by openings, with shutters near the floor, with ventilators from each story through the roof.

"3. I have fed in open sheds and tents with *complete success.* I fed this year four several successive lots, and gathered the cocoons from the same cradles. The first was fed in June, the last in September, both perfectly healthy: they made superior cocoons.

"4. The salmon pea-nut is the best; white pea-nut next; gold pea-nut 3d;

Piedmont 4th. Mammoth varieties are also good. I have no faith in any two-crop varieties whatever, after five years' experimenting with all kinds recommended; but would observe, that those who wish eggs to hatch, must select the pure white cocoons from the first lot fed, to get millers to lay eggs for the second lot.

"5. White mulberry and multicaulis are best. I cultivate them as I do corn, and replant the multicaulis every three years.

"6. In previous years, my first lot of worms were fed early in the season: they have always been the best.

"*The Causes of Disease.*—1st cause is, eggs saved from unhealthy stock; 2d. Eggs being improperly preserved; 3d. Irregular feeding and unwholesome food; 4th. Changing the worms while moulting; 5th, and most frequent cause, want of pure air, and neglect to remove the excrements immediately from the worms; 6th. Letting the mice eat them during their last age, and while they are winding their cocoons.

"I have been successful beyond my most sanguine expectations in feeding in the shed and ventilating cradles. Have gathered four lots from each, averaging seven bushels per cradle, or near two bushels at each gathering per cradle.

"I think our cocoons will average twenty ounces of silk per bushel. The cost to me this year for producing them will not exceed two dollars per bushel.

"I am completely satisfied that my system of shed, or tent and cradle, and branch feeding, is a system for *general* adoption, and will produce more cocoons than any other method yet introduced, at half the usual expense, during three to four months each feeding season. Cold weather, in early and late feeding, may retard the worms in eating, and lengthen their time a little in spinning, causing, however, no other injury; and for warm, sultry weather nothing can supersede them. Many others have used them, and advised me of their complete success."

"Dr. Daniel Stebbins, *Northampton, Massachusetts.*—I give the following answers to your several questions:

"I have fed worms for seven or eight years, with the sole view of showing that it *could* be done. This year I made twenty-five to thirty pounds of silk.

"This season I erected a new cocoonery in the midst of a mulberry patch, forty-two by twenty, posts eight feet *out* of ground. Roof covered with boards and battened, the sides and ends covered with slats three inches wide, and half an inch apart, extending from the eaves to the ground. Floor of earth.

"Adjoining the above is a tent *wholly* covered with bass matting, through which the rains had a free passage. The success of the tent was superior even to the cocoonery.

"I have fed for several years in an open shed, in the barn-yard, but nothing to exclude birds and fowls; in other respects the experiment was successful.

"For making silk, the pea-nut variety has the preference, being less encumbered with floss, less gum, more length, lustre, and strength of fibre than other varieties, as testified by a skilful silk-dyer.

"Having the *black, white, Canton, Asiatic, Broosa, multicaulis*, and some other varieties, I have not found any to excel the *Canton* for its foliage, and the *Asiatic* for its abundant branches. The foliage of the *Canton* continues to the latest season in greater perfection than any other.

"An early crop of worms is preferable to a late crop. The foliage becomes abundant the latter part of the season, but is very unfit for the worms, being too hard, or deprived of its richness by drenching or long-continued rains.

"It was my expectation and intention to test the use of the mulberry foliage, both in its *green* and *dry* state, for making paper, and for that purpose had sent a quantity to the paper-mill, but cannot have the experiment fully tried at present."

"Mr. H. P. Byram, *Brandenburg, Ky.*—With pleasure I respond to the questions contained in the 'Silk Circular' of the American Institute.

"I have fed silk-worms to a greater or less extent in the State of Kentucky, every season except one, since the year 1837 inclusive, and generally with good success, loss by disease in no lot exceeding fifteen per cent., and often not over three per cent.

"I have fed in enclosed buildings, ventilated by doors, windows, and openings under the latter, and heated by a stove when necessary.

"The present season I fed in an *open shed* with decidedly good success: worms healthy: they wound large, fair cocoons.

"I have fed every variety of worms that I could procure, and give the preference to those called the *Chinese Imperial*, and a variety represented to me as the pea-nut.

"I feed from the multicaulis in the first stages, and in the last stage use all the white and Canton that I can procure.

"The multicaulis should be cut off near the ground every *three* years, one *third* of the field each year. The other varieties I *head down* every year. I feed branches in the last stages.

"I have hatched and fed worms in every month from April to August, the earliest fed always producing the heaviest cocoons. The latter equally healthy when the eggs have been properly kept and managed. But few persons have succeeded in late feeding, from the want of proper care of the eggs.

"The causes of bad success that have come to my knowledge have been owing either to bad eggs, bad management, or the want of free circulation of air in the apartment.

"The hatching of eggs can be *perfectly* retarded by being placed in a tin box, enclosed in a wooden one, and suspended in the *body* of the ice *near* the bottom of the ice-house. This is done by introducing a long box, cut in three lengths and placed on end, soon after the first portions of ice are thrown into the house. The top joints can be removed as the ice settles: the eggs at no time to be above the body of the ice. They should be placed in the ice in February or early in March."

"Mr. Barbour, *Oxford, Mass.*—It is fifteen years since I began to examine the silk business.

"The results of my own labours are decidedly in favour of early feeding. Out of all the crops that I have carried through by the middle of August, I have never lost by disease five per cent. in any case. Not so with later crops generally, although this year my later crops were healthy, and made first-rate cocoons.

"As to buildings, I have fed in a large, open garret, in a corn-house and a carpenter's shop. In 1840 I built a regular cocoonery, thirty by twenty feet, two stories high, with ten windows in each story, and warmed by a hot-air chamber in the cellar. In 1842, fed a lot also in an *open shed*, and this year in a *tent*, with cradles, on Mr. Gill's plan. The result of the whole is, in my judgment, *the more air the better*, only guarding against sudden gusts of wind, that will disturb your leaves or bushes.

"As to ordinary turns of cold weather, in our summer months, their effect is to render the worms torpid. Of course they will not, in this state, eat and grow, and there is a loss of time in getting them through; and this is the only loss to be apprehended. Upon returning warmth they revive, and go on with their labours, apparently uninjured.

"*Trees.*—My first movement (1837) was wrong. I bought a lot of mulberry seed as 'genuine Chinese Mulberry Seed,' which proved to be an inferior variety of the white: lost two seasons in getting started, and some patience withal. In 1839, planted one hundred dollars worth Alpine cuttings. According to the '*books*,' I was not to lose one in fifty: in the result, did not get one in fifty. I should almost as soon recommend the propagation of oak bushes by cuttings as the Alpine or other hardy varieties of the mulberry. Same year, planted Canton and multicaulis. They vegetated very well, but made a small growth. I had been taught to believe that the mulberry-tree would flourish where nothing else would grow—quite a mistake. I took my trees up too early, and lost many the ensuing winter.

"Thus far I had been operating upon rented lands. In 1840, began on the farm where I now live—lands all sadly exhausted; not an acre on the farm that would give half a ton of hay. I planted two acres, chiefly with multicaulis and Cantons, by laying the trees whole length in the furrow, manuring them with a cheap compost, made principally of peat mud properly prepared. They did well, and made an average growth of three feet. Let them stand as they grew, and they all wintered safely. In 1841, planted three acres more in like manner; season dry, average growth two feet: left all out as before.

"But the winter of 1841–42 was very open: no snow, frequent and heavy rains, with constant freezing and thawing. My ground is a *plain*, very level, and the water stood and *froze* in many places: trees not ridged up with the plough in summer cultivation, as they should have been on such land, to guard against this danger. The result was, that I lost the whole of the three-acre lot, and at least three fourths of the other.

"To me this was a sad disappointment, and for a few days in March, 1842, for the *first* and the *last* time, I had feelings of unconquerable discouragement. In this state, my first movement was to despatch some twenty-five to thirty letters of inquiry to silk-growers in New-England. The mails in due time brought me this return, that the injuries of the winter, severe as it was, had been confined to trees planted, as mine were, *whole* and *horizontally*, on *flat ground*, without being ridged up, and those of small growth. I was greatly relieved to learn that, in all cases where they had been set *deep, one root* in a place, on dry, sloping land (or ridged, if flat), rich enough to make good extended roots the first season, they had gone through the winter safely, pre-eminently bad as it had been.

"Feeling, therefore, that I then knew the *worst of the case*, I went directly to work, with augmented confidence, to repair my loss. I ploughed up all my lands, saving every live tree, sent thirty-five to forty miles and bought others, so as to plant seven to eight acres, and thus *began the silk business anew*, in 1842, and *began right*.

"As to trees, I prefer the multicaulis, the large-leaf Canton, and the Asiatic. Managed as indicated in the above details, they are essentially safe from the perils of winter anywhere between Canada and the Gulf of Mexico. If not thus managed, they are in danger anywhere and everywhere, where it is cold enough for *ice to form* and the *ground to freeze*. It is not the *degree* of cold that does the injury in this and similar cases, but *freezing* and *thawing*. Everybody knows that a *peach-tree* is more safe on the *north* than on the *south* side of the wall, and for the reasons here stated. I would not, therefore, give a dollar for a full ensurance on all my trees if the thermometer, in December, will drop down to twenty degrees below zero, and *stay there* until the last of March.

"As to the feasibility of the silk business in this country, I have no doubt. I must unlearn all that I have learned upon the subject for fifteen years, undo all that I have done, and unsay all that I have said—unhinge and upset all the abiding and fixed impressions upon my own mind before I can begin to doubt."

SILK-WEED. The *Asclepias seriaca*, the seed vessels of which contain a long, silky down, sometimes wrought into fabrics by private persons.

SILL. The horizontal and lower piece of a window or other framing: also, the shafts of a cart.

SILT. The loose sandy matters that accumulate in rivers.

SILURIAN ROCKS or SYSTEM. The upper portion of the transition rocks found below the old red sandstone.

SILVER. A well-known metal: it is soluble in nitric acid, the salt (*nitrate of silver*) being used as a caustic in farriery, and in the laboratory as a test for chlorine, with which it produces a white, curdy compound (*chloride of silver*) that is soluble in ammonia, and blackens by exposure to light. Equivalent 108·3, symb. Ag.

SILVER GRAIN, IN WOODS. The bright markings; the medullary rays.

SILVER-WEED. *Potentilla anserina.* A perennial running weed with yellow flowers, and five-parted, silvery leaves, growing on poor soils.

SINAPISM. A mustard poultice or other preparation.

SINCIPUT. The forehead.

SINUS. A cavity: the veins of the brain are so called.

SINUOUS. Full of cavities, tortuous.

SIT-FAST. "In farriery, an ulcerated sore in which a part of the skin has turned horny; if it cannot be dissolved and softened by rubbing with mercurial ointment, it must have a mild blister applied, which will cause it to separate. It generally proceeds from a warble or little tumour resulting from the pressure of the saddle."

SIZE. A thin glue made from skins.

SKEGS. The *Avena stipiformis.* A kind of oat cultivated in Nottinghamshire, England.

SKELETON. The bony frame on which the muscles and soft parts are placed.

SKID. A drag chain.

SKIM COULTER. See *Plough.*

SKIN. The external coat of animals. It consists of a scarfskin, or epidermis, a *rete mucosum*, which is thin and coloured, and the *cutis vera*, which forms the substance, and from which hairs, &c., proceed.

SKIRTING. In building, the narrow, horizontal board running along the walls of a room at the floor.

SKIRRET. *Sium sisarum.* Chervis. "This plant is first cultivated by seed, and afterward by offsets taken from the old roots, and planted very early in the spring, before they begin to shoot; but it is best to raise a small bed from seed every year, as the roots grow longer than those raised from slips, and are less liable to be sticky. The seed may be sown in drills the latter part of March, or early in April, and managed the same as salsify, parsnip, &c. In autumn, when the leaves begin to decay, the roots are fit to use, and continue so till they begin to shoot in the spring.

"Skirrets should be planted in a light, moist soil, for in dry land the roots are generally small, unless the season proves wet.

"The root of the skirret is composed of several fleshy tubers as large as a man's finger, and joined together at the top. They are eaten boiled, and stewed with butter, pepper, and salt, or rolled in flour and fried, or else cold, with oil and vinegar, being first boiled. They have much of the taste and flavour of a parsnip, and are by some considered a great deal more palatable."—(*Bridgeman*).

SKUNK CABBAGE. *Symplocarpus fœtida.* Marsh cabbage. A large-leaved plant of the family *Aroidæ*, growing in wet places at the north; it has a vile odour, and is reputed antispasmodic.

SLATE. Any rock which has a close texture and is readily split into slabs. The term is more particularly applied to the fine aluminous slates used in roofing and for writing upon.

SLEEPER. Timbers on which are laid the ground joists of a building or railway.

SLEET. A cold rain mixed with snow.

SLIPS. Twigs or small branches torn from a tree or bush for the purpose of propagation. Spring or autumn is the time to do this. They should be set in a rich spot and kept moist. Flower slips are commonly set in pots in the green-house: charcoal forms a good soil to strike them in.

SLOE. In Europe, this name is

given to a small wild plum, the *Prunus spinosa*, which is used as a dwarf stock for grafting plums. In the United States it is given to the *Prunus pygmæa*, and also the *Viburnum prunifolium*.

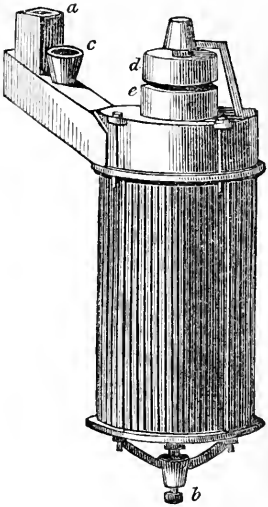
SLOUGH. A name given to decayed matters separating from a wound: proud flesh; a muddy hole. It may be remedied in a road by sinking pebbles and small stones into it.

SLUGS. Naked moluscous animals. See *Insects*. This name is also given to the larvæ of some sawflies which infest pear, cherry, and other trees. They are all destroyed by salt, lime, or whale-oil soap solution.

SLUICE. A frame of timber, stone, or other solid substance, serving to retain and raise the water of a river or canal, and, when necessary, to give it vent. See *Irrigation*.

SMUT. For an account of the various diseases known under this name, see *Burned Ear* and *Uredo*. The best preventives known are to keep the lands occasionally limed or salted, never using too much rank stable manure without some saline matters; and, secondly, steeping the seeds before sowing in solution of *sulphate of copper* (blue vitriol). One ounce and a quarter of the salt is used to a bushel of wheat: it is dissolved in just enough water to wet the grain, which is steeped for three quarters of an hour, and dried by being spread out. A strong brine and milk of lime are also used with good success; but the copper solution is very superior.

SMUT MACHINES, or GRAIN CLEANERS. These are of service to the miller chiefly. They consist of interior brushes revolving in a roughened cylinder, usually set in an inclined direction. The brushes rub the grain against the rough surface, and by this means rub off the smut, or break open the injured kernels. A fan is added for the purpose of driving a current of air through the cylinder, which carries off the smut balls and other light rubbish out above, and allows the perfect grains to reach the bottom of the cylinder and pass out. There are a great number of patents: those of Messrs. Young, Henry A. Buck, George D. Waldo, and Wm. C. Grimes are in great esteem. The figure represents Messrs. Bird and Weld's machine; it possesses decided advantages, having separate pulleys, *d* and *e*, to drive



the fan and beating cylinder at different velocities, by which arrangement buckwheat and other tender grains may be cleansed without breaking, by reducing the speed of the beating cylinder, while a full current of wind may be kept up with the fan, running at any required speed for that purpose. When in use, a pipe is added to *a*, to increase the draught, and a sieve at *b*, to separate the grain: *c* is the hopper.

SNAILS. *Helicidæ*. See *Insects*.

SNAKEROOT, THE VIRGINIAN. *Aristolochia serpentaria*. A perennial-rooted plant, growing wild in woodlands, the root of which is collected for the druggists, and used as a bitter and tonic.

SNEAD, or SNATHE. The handle of the scythe: it should be of ash, light, but not flexible.

SNOW. Congealed moisture: it is produced whenever a cold wind below 32° Fahrenheit acts upon the moisture of warmer clouds. It is an excellent covering for winter crops, protecting them from the winds and sudden changes of winter; it also protects roots and the bark of trees from mice.

SOAP. "This useful compound is obtained by the action of alkaline upon oily substances. There are, accordingly, a great variety of soaps; but those commonly employed may be considered under the heads of, 1. Fine white soaps, scented soap, &c.; 2. Coarse household soaps; 3. Soft soaps. The materials used in the manufacture of white soaps are generally olive oil and carbonate of soda: the latter is rendered caustic by the operation of quicklime, and the solution thus obtained is called *soap lye*. The oil and a weak lye are first boiled together, and portions of stronger lye are gradually added till the soap, produced by the mutual action of the oil and alkali, begins to become tenacious and to separate from the water; some common salt is then generally added to promote the granulation and perfect separation of the soap: the fire is then drawn, and the contents of the boiler allowed to remain for some hours at rest, so that the soap may more completely collect. When it is perfect it is put into wooden frames or moulds; and when stiff enough to be handled, it is cut into oblong slices and dried in an airy room. Perfumes are occasionally added, or various colouring matters stirred in while the soap is semifluid, to give it a mottled appearance. The Spanish soap is *marbled* by stirring into it a solution of sulphate of iron, which is decomposed by the soap, and black oxide of iron separated in streaks and patches through the mass. The action of the air converts the exterior into red oxide, while the interior long retains its black colour; hence a slice of this soap presents a black mottled centre, surrounded by a reddened external layer.

"Common household soaps are made chiefly of soda ash and tallow; or if potash is used, a large addition of common salt is made to harden the soap, which it probably effects by the transference of soda. Yellow soap has a portion of rosin added to it. Soft soaps are generally made with potash, instead of soda, and fish oil. The common soft soap is a compound of this kind; it has a tenacious consistence, and appears granulated. Soap is soluble in pure water and in alcohol; the latter solution *jellies* when concentrated, and is medicinally known under the name of *opodeldoc*. When carefully evaporated the soap remains in a gelatinous state, which forms, when dry, the article sold under the name of *transparent soap*.

"The earths and common metallic oxides form *insoluble soaps*; and, accordingly, these are precipitated when earthy and metallic salts are added to solution of soap. It is the sulphate of lime and carbonate of lime in common spring water which thus render it unfit for washing, and give it what is termed *hardness*; and, upon this principle, a spirituous solution of soap is a simple and valuable test of the fitness of any river or spring water for the purposes of the laundry. If it merely renders the water slightly opalescent, as is the case with rain and other soft waters, it may be used for washing; but if it become milky, it is usually too hard to be conveniently employed; and when we wash or shave with hard water, the separation of the insoluble calcareous soap is extremely disagreeable; it adheres to the skin, and soils instead of cleansing it.

"The chemical nature of soap has been laboriously examined by Chevreul, who has shown that the alkali in the process of saponification converts the oil into peculiar *acids*, as he terms them; the elain of the oil forming *oleic acid*, and the stearin *margaric acid*: so that soluble soaps are oleates and margarates of soda and potash. He has enumerated several other fatty acids similarly produced.

"All new soaps contain a considerable portion of adhering water, a great part of which they lose when kept in a dry place; hence the economy and excellence of *old* soap; and hence the dealers in soap generally keep it in a damp cellar, that it may not lose weight by evaporation; or, as it is said, sometimes immerse it in brine, which does not dissolve it, but keeps it in its utmost state of humidity."

SOAPER'S WASTE. The refuse of the soap-works has been much used as a manure. The nature of the manure depends on the use of ashes or soda ash in the manufacture: in the first case, it is a very valuable amendment; in the latter, considerably less so. The first contains a large quantity of ash, the chloride of potassium; the second contains but little soda salts, and when barilla is employed, the ash is merely calcareous matter: of the latter ashes, in the fresh state, from 60 to 200 bushels have been used on grass lands with great effect. If ashes and common salt have been used, 10 to 20 bushels of refuse will be enough. The gelatinous substance remaining after the separation of the soap is called glycerine, and does not contain nitrogen; it is not, therefore, of much moment alone.

SOAPSTONE, STEATITE. A gray, soft mineral, consisting of silicate of magnesia, coloured by two and a half per cent. of iron.

SOBOLE. An underground creeping stem.

SOD. A turf of grass.

SODA, PROTOXIDE OF SODIUM. An alkali very analagous and isomorphous with potash. Equivalent, 31·31, or 23·31 sodium and 8 oxygen: symbol, Na O. It is constantly found, in the ashes of plants performing the same function as potash; but in the vine and some other plants it is not equally serviceable. In the mineral kingdom it is abundant as a silicate, but especially in the form of *chloride* of sodium, or sea salt (see *Salt*); the nitrate, which is an important manure, is also abundant in certain places (see *Nitrates*).

Kelp, barilla, and soda ash all owe their value to the carbonate of soda, which is used in making hard soaps. The carbonate of soda resembles pearlash very closely in its properties, but is less active.

SOIL. "The nature and composition of soil, and, consequently, its greater or less aptitude to the growth and maturity of vegetable productions, depend chiefly on the proportion and mechanical structure of the various substances of which it consists. When the soil is favourable to the chemical action by which the elements are combined to form vegetable substances, and admits that quantity of air and moisture without which this chemical action cannot take place in any given climate or temperature, vegetation goes on rapidly, and all the plants which are suited to the climate grow in the greatest perfection and bear abundant fruits.

"It is not, however, very frequently the case that a soil possesses all those qualities on which great fertility depends. So many circumstances must concur to make a soil highly fertile, that the great majority of soils can only be made to produce abundantly by being improved by art both in their texture and composition. Hence the practice and science of agriculture, which is founded on experience, but to which every progress in science also affords great assistance, by the additional light which every new discovery throws on the true theory of vegetation.

"There are various modes of distinguishing soils, without here entering into a minute analysis (see *Analysis*) of their component parts. The simplest and most natural is to compare their texture, the size and form of the visible particles of which they are composed, and to trace the probable source of their original formation from the minerals which are found around or below them, or the rocks from which they may have been slowly separated by the action of the elements. The science of geology, which teaches the relative position and nature of the minerals of which the outer crust of the earth is formed, is consequently of the greatest utility in aiding us to compare different soils, and ascertaining their composition.

"The knowledge which geology imparts is, however, not sufficient for the minuter classification of soils; for it is found by experience that the soils which lie over or near the different strata, as they appear near the surface, vary greatly, although they retain some general character which distinguishes them from others. The streams which descend from the hills, and flow towards the valleys, and through them to the sea, carry to a great distance the minuter portions of the minerals which they flow over in their course, while the larger and heavier are deposited much sooner. Hence the heterogeneous mixture of various earths and stones, and their stratification in thin layers, as is often found when a soil is examined which has never been disturbed by cultivation. A sudden flood, rising rapidly, carries stones and fragments of rocks in its course, while a gentler stream deposites fine sand or clay over these, and forms every variety of sandy, gravelly, or clayey soil. If chalky hills are near, carbonate of lime abounds in almost every proportion, with its usual concomitant, irregular flints. If the waters have accumulated in a basin, and formed a temporary lake, the soil will consist of all the finest portions of the minerals, which, from their minute size, have remained long suspended in the still waters, and slowly deposited in the form of mud. In proportion to the shallowness of the lake, vegetable matter will have been produced, and intimately mixed with the minerals; and, where vegetation has gone on rapidly, peat and soft bogs are formed.

"It is not sufficient to class soils according to the substance which predominates, as has been usually done, such as sandy, gravelly, chalky, or clay soils; for this gives very imperfect information respecting their nature or fertility; neither is it altogether sufficient to class them according to any particular geological formation. It is important to enter into a more minute examination of their component parts. But as the geological investigation of the different strata is a great help in the examination of soils, we will in the first place give a short description of those which have the most distinct characters, from their connexion with different geological formations.

"The soils which are immediately derived from those rocks in which no traces of organic remains are to be found consist either of visible fragments of quartz and other hard minerals, which are not affected by exposure to air or water, and are only ground and comminuted by being rubbed against each other in floods and torrents, or of minuter particles of the same, of which the shape is not readily distinguished by the naked eye. When they are altogether composed of visible particles and stones, the water readily passes through them; and unless they are kept continually moist by a regular irrigation, without any stagnation of the water, they are absolutely incapable of sustaining vegetation, or of bringing fruits to maturity. It is seldom, however, that any gravel or sand does not contain some portion of earth or other matter, of which the particles become invisible when diffused through water, and to which, for the sake of perspicuity, and to prevent confusion, we will here give the general name of *impalpable substance*. A certain portion of this finer part of the soil, and its due admixture with the coarser, especially where there is some regular gradation in size, and no stones of too large dimensions to obstruct the instruments of tillage, may be considered as essential to fertility. The chemical composition of the impalpable substance, no doubt, greatly affects the degree of fertility; but the general texture must be considered as by far the most important circumstance. To improve this texture permanently is the great object of all the labours of the husbandman. For this purpose, he carries various earths from one spot to another; clays one field, and limes or chalks another; brings peat upon sands and clays, and carries gravel and lime on his peat bogs. Without an adequate knowledge of the composition and texture of a soil, it is impossible to make permanent improvements with any certainty, or without incurring the risk of failure or of useless outlay.

"The soils which have been formed from the disintegration and decomposition of the primitive rocks, such as granite, basalt, schist, or limestone, and especially those which contain all these minerals, minutely divided and intimately mixed, are always naturally fertile, and soon enriched by cultivation. The hard particles of quartz maintain a certain porosity in the soil, which allows air and moisture to circulate, while the alumina prevents its too rapid evaporation or filtration. The silicate of potash also seems highly favourable to the vegetation and growth of those plants which contain silica in their stems, such as the gramineæ, especially wheat, of all plants the most important to the husbandman in our northern climates. If organic matter be an essential ingredient in a fertile soil, it is soon produced by cultivation, or added by judicious manuring.

"Where there is a deficiency of impalpable matter, and the fragments of the rocks of which the soil is composed are large, and lie loosely, it is in vain to expect vegetation, except along gently flowing streams, which supply the roots with moisture, and thus form a bed of vegetable matter; but in a climate suited to the vine, and in a good exposure, these loose soils often produce excellent wine, as may be seen along the steep banks of the Rhine and other rivers. The roots of the vine run deep into the fissures of the rocks below, and there find nourishment suited to their nature

"The primitive limestone, which is very hard, is yet gradually decomposed by the action of air and water, being, in a very small degree, soluble in the latter. The water which flows through these rocks is soon saturated; but when it springs out and comes to the light, the carbonate of lime is deposited by the evaporation of the water; and if this meets with the clay which results from the decomposition of the slate, it forms a marl, which, naturally or artificially added to silicious sand, forms the basis of a very good soil, particularly well adapted to pasture.

"The soils which have been evidently formed from the rocks which are supposed to be of secondary formation are fertile according to the proportion of the earths of these rocks which they contain. It is of these chiefly that those loose, sandy soils are formed of which the particles appear as distinct crystals, easily distinguishable with the aid of a lens, or even by the naked eye. Air and water have been the chief agents in the decomposition of those secondary rocks called sandstones, and agitation in water has washed from them the finer portions, which have remained suspended. The immense sandy plains which are either barren, or have been fertilized with great trouble and expense, have probably once been the shores of the sea, from which the waves have washed all that portion which was impalpable and easily suspended in water, depositing this in the depths, which, by some convulsion of nature, may some time or other be raised above the level of the waters, and form hills or plains of clay, such as are often found in extensive basins of great depth.

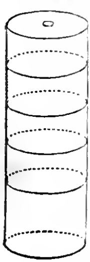
"Argillaceous earth exists in some proportion in almost every rock. Some of the hardest gems are chiefly composed of alumina. It has the property, when mixed with other substances, as silica or lime, of fusing into a stone of great hardness and insolubility. In this state its effect on the soil is not to be distinguished from that of silica; and by burning common clay, or clay mixed with carbonate of lime, a sandy substance is produced resembling burned brick, which tends greatly to improve the texture of those clays which contain little or no sand in their composition. It must be remembered that the stiffest clays contain a large portion of silica in an impalpable state; but this, instead of correcting their impermeable and plastic nature, rather adds to it. It is only palpable sand which, with clay, forms what is commonly called loam, and which, when the sand is in due proportion with a mixture of organic matter, forms the richest and most easily cultivated soils. Some of the rocks of secondary formation contain a considerable portion of alumina and lime; and when these earths meet with crystallized sand, a compound, or, rather, a mixture is formed, which has all the requisite qualities, as to texture, to produce the most fertile loams. The only deficiency is that of organic matter; but this is so readily accumulated wherever vegetation is established, or can be so easily added artificially, that these loams may always be looked upon as the most favourable soils for the usual agricultural operations: and if a considerable depth of loam is found which neither retains water too long nor allows it to percolate too rapidly, it may be looked upon as a soil eminently capable of the highest degree of cultivation, and on which no judicious outlay of labour will ever cause loss or disappointment to the farmer.

"The alluvial soils formed by the deposite of a variety of earths in a state of great division, and mixed with a considerable portion of organic matter, form by far the most productive lands. They will bear crop after crop with little or no additional manure, and with a very slight cultivation. These soils are found along the course of rivers which traverse extensive plains, and which have such a current as to keep very fine earth suspended by a gentle but constant agitation, but not sufficiently rapid to carry along with it coarse gravel or sand. Wherever there is an obstruction to the current and an eddy is formed, there the soil is deposited in the form of mud, and gradually accumulating, forms those alluvial soils which are so remarkable for their fertility when carefully protected from the inroads of the water. In these soils the impalpable matte greatly predominates; but the intimate mixture of the earths with organic matter, in that state in which it has been called *humus*, prevents their consolidating into a stiff clay; and the gases which are continually evolved from the organic matter keep the pores open, and give scope to the growth as well as the nourishment of the roots. It is in the alluvial soils principally that an accurate analysis is useful; because the proportion of their constituent parts varies in innumerable degrees. It may be laid down as a general rule, that the most fertile of these soils are those in which the primitive earths are nearly in equal proportions, silica being the most abundant, with about ten per cent. of organic matter; a greater proportion of this last would form too loose and spongy a soil to bear good crops of corn, especially of wheat. But four per cent. of humus, with a good mixture of earths, and some phosphate of lime from the decomposition of bones and marine shells, produces a very good wheat soil. The rich warp-lands along the Humber are artificial alluvial soils, and although they contain but a small proportion of humus, are highly fertile after their first deposition, but it is observed that they gradually become more tenacious and difficult of cultivation as this humus is carried off by the crops, and that it is soon necessary to add animal and vegetable manures to supply its deficiency.

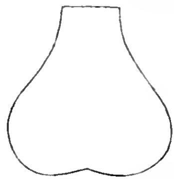
"Organic matter is no doubt essential to great fertility in a soil, but some soils require more of it than others. *Humus*, which is the form which organic matter naturally comes to by slow decomposition in the earth, gives out certain elements which the roots can take up in their nascent state, and from which they obtain the carbon which is so abundant in all vegetable productions. But organic matter, in every stage of its spontaneous decomposition, keeps the pores of the soil open, and admits, if it does not even attract, air and moisture to the fibres of the roots. In all rich soils which have been long cultivated, especially in gardens, there are particles of a dark colour and fibrous texture, which, in the microscope, appear like minute logs of charred wood. These keep the soil open, and supply carbonic acid, when the air reaches them, or they are slowly transformed into humus, which remains inert as long as it cannot imbibe oxygen and form carbonic acid by a species of slow combustion. Humus is no doubt one of the chief causes of fertility, but its presence does not appear to be so indispensable as has been imagined. A proper texture seems a much more indispensable condition. Humus can undoubtedly be formed from the elements of water and of the atmosphere. Whether it be directly, or by the slow process of vegetation and subsequent decomposition, does not so readily appear, but it is certain that there are soils which are highly fertile in which scarcely a trace of humus can be discovered, and which, from their igneous formation, cannot well contain organic matter; such are the soils which are produced by the decomposition of the lava which has run in a liquid state from the craters of volcanoes. This is composed of different minerals, which have been fused by the action of heat, but in which the mixture of the earths and salts has not been in such proportions as to form a perfect glass. When exposed for a time to the influence of the atmosphere, the lava crumbles into an earth, which is neither so loose as silicious sand, nor so plastic as clay, and which has such a porosity as suits the growth of the roots of vegetables. By the effect of a warm climate and frequent rains, vegetation goes on rapidly, and by cultivation humus is soon formed and accumulated, so that it is only in the more recently cultivated lavas that it can be said that vegetation goes on without any supply of organic matter; and the addition of humus greatly increases the fertility of these soils. It is much easier to supply the deficiency of humus, which at best forms but a very small portion of the soil, than of silica or alumina, which should enter into its composition in the proportion of one half or a third of the whole. It is practicable to carry lime or chalk upon soils which do not contain calcareous matter; clay may also be carried upon loose, sandy soils, where it can be found below the surface, or at a moderate distance; but if a soil is very deficient in silica, it requires so large a proportion of this earth to give porosity to stiff clay, that it very seldom can repay the trouble and expense. Hence the difficulty of bringing poor, wet, clay soils into a fertile state, except where an abundance of chalk and vegetable manures can be easily procured. In this case, the perfect draining of the land, and exposure of the ploughed surface to the frosts of winter, with the addition of chalk and manure, produces such an alteration in the texture of the clay, that, by continuing the improving process, it is entirely changed into a mellow and fertile loam. The burning of a portion of the retentive subsoil into a brick-like earth gives it a porosity which renders it mechanically similar to silicious sand, and converting the iron which all these clays contain into a peroxide, the soil is thereby greatly improved in fertility; for it seems that iron, in a state of slight oxidation, or combined with any acid, is hurtful to vegetation, whereas the red peroxide is not only innocuous, but seems to have fertilizing properties.

"The comparison of the different fertile soils leads, therefore, to the conclusion that the texture or porosity arising from the admixture of particles of various dimensions is the most important object of examination; and subordinate to this is the chemical constitution of the earths and other substances of which it is composed. In the examination and analysis of soils for the purpose of ascertaining their power of production, we must, therefore, first examine them mechanically, and afterward chemically, and on this principle has been proposed the mode of *analyzing soils*, in a paper which obtained one of the first prizes given by the Royal English Agricultural Society, and published in the first number of its journal. We will here insert a short account of the process, with such alterations and additions as more extensive practice has suggested.

"There are two easy methods of ascertaining the size of the particles of a soil. The first and simplest is by drying the portion under examination, gently triturating it with a wooden pestle in a mortar, so as not to produce a grinding of the more solid portions, and then separating the coarser from the finer parts by means of several metallic sieves of different fineness. A simple instrument is recommended for this purpose, which is very portable, and consists of three or four sieves fitting into each other; the coarsest sieve being uppermost and covered with a lid; the finest fitting into a recipient, and the whole forming a cylinder three or four inches in diameter, and from six to eight in height. The coarsest sieve has threads at the distance of $\frac{1}{20}$ of an inch, the second has 80 in an inch, the third 120, and the fourth is the finest metallic tissue which can be made. What remains in the first two is easily examined by the eye, or with the help of a lens. The third and fourth require a microscope to see whether any crystallized particles remain in the impalpable dust which has gone through all the sieves. By carefully weighing these different earths their proportion is known, and by taking the specific gravity of each their nature can be guessed at with tolerable accuracy.



"As this analysis is not intended for experienced chemists, the simplest methods are preferred to the more accurate. There is a mode of taking the specific gravities of substances which are in the form of powder insoluble in water, so easy and so little liable to error, that any person, however unaccustomed to experiments, can soon become sufficiently expert to have full confidence in the result. It is as follows: a small, pear-shaped vial is blown of thin glass, and the neck cut and ground



smooth. The size is such as to contain 300 grains of water, more or less; the exact quantity is not essential. It is now filled with pure water at 60° of Fahrenheit's scale, and accurately poised in a delicate balance: 100 grains weight are then placed in the same scale with this vial, and, by means of a very fine tube, water is gradually sucked out of the vial till the equilibrium is restored; that is, exactly one hundred grains of water have been taken out. A counterpoise is now made of lead or brass, when the 100 grains weight has been removed, and this serves for all future experiments. When the specific gravity of any substance is required, the vial, partly filled with water, is placed in one scale, and the counterpoise, made as above described, is placed in the other; water is added or taken from the vial till an equilibrium is obtained. The substance to be tried is slowly and carefully poured into the vial, until the water rises to the ground surface of the neck and stands quite level, which is easily seen by observing the reflection of the light from the surface. It is then carefully replaced in the scale, and grain weights are added to the other scale to restore the equilibrium.

The number of these grains at once indicates the specific gravity of the substance ; for the space above the water was that of 100 grains of water, and this space is now filled up by the earth examined. Its weight, therefore, denotes its specific gravity compared to water as 100 ; and as a delicate balance readily turns with a decimal of a grain, the decimals give the specific gravity to the third figure. Thus, if the grains are 256 and the decimals 4, the specific gravity is accurately 2564, water being 1000.

"By taking the specific gravity of the pure earths, it is found that silica is the heaviest, the next is carbonate of lime, and the lightest is alumina, while organic matter is much lighter than any earth. Thus, a tolerable guess can be made of the composition of that impalpable portion of the soil which generally contains all the salts and organic matter. To separate these chemically requires more experience and a more extensive apparatus ; but the quantity of carbonate of lime in any soil which effervesces with acids, when its presence is thus ascertained, can be calculated by a simple process, almost as easily as the specific gravity ; for this purpose, it is necessary to have a balance with a somewhat larger scale, in which can be conveniently placed a small glass cup and a vial. The cup is placed in the scale with 100 grains weight in it ; and the vial, also containing 200 or 300 grains, more or less, of very dilute muriatic acid. The whole is accurately poised Fine dry sand is the most convenient counterpoise when the exact weight is not required. The 100 grains are now taken out and replaced by the dried soil to be examined. When the equilibrium is restored, the diluted muriatic acid is poured carefully and gently on the earth in the cup as long as it continues to effervesce ; it is then left for a while, and a little more of the acid added. If no bubbles appear, then all the carbonic acid has been expelled, and the opposite scale preponderates. The grains and decimals of grains required to restore the equilibrium give the weight of the carbonic acid expelled, which will sometimes be considerable. Since 100 grains of carbonate of lime contain 44 grains of carbonic acid, we have only to take the proportion as follows : let a denote the grains of carbonic acid indicated in the experiment ; then, $44 : 100 :: a : \frac{100a}{44}$ = the quantity of carbonate of lime in the soil ; that is, multiply the grains added to the scale by 100, and divide by 44. This experiment, repeated with a very accurate balance, will surprise by its correctness ; and no chemical analysis could give it with equal certainty, especially in the hands of an inexperienced person. When the weights are ascertained by substitution, the accuracy of the balance is of less consequence ; all that is required is that it be sensitive, or turn readily by the addition of very minute weights. Thus, by two simple and easy experiments, some of the most important qualities of the impalpable portions of a soil may be accurately ascertained, viz., its specific gravity, and the quantity of carbonate of lime which it contains.

"It is more difficult to separate the fine silica from the alumina, and this is of less importance than might be supposed ; for silica, when extremely divided, so as to remain long suspended in water, and mixed with alumina, becomes as impervious to water as alumina itself, and therefore its mechanical effect on the soil is the same. For farther information, see art. *Analysis*.

"The coarser portions of the soil, which have been separated in the sifting, are easily examined by the eye. If repeated washing carries off nothing from them, they may be considered as so many crystals, which have no other effect in the soil than to keep it open. If some of these are of a calcareous nature, they will dissolve with effervescence in muriatic acid, and their proportion can be ascertained by the process above described ; if not, they may be a considered as mere silicious sand or gravel

"A good soil is composed of one third coarse sand, one third very fine sand, and one third impalpable matter, in which there is silica in the greatest quantity, alumina and lime in a smaller, and from four to ten per cent. of organic matter, without any appearance of tannin, which is readily discovered by pouring into the water which has filtered through it a weak solution of sulphate of iron; if a blackness appears, the gallic acid is present, and in proportion to its quantity the soil is less fertile. In this case quicklime is the best corrective.

"In ascertaining the value of a soil for the purposes of agriculture, two circumstances should be carefully noticed: the first is the permeability of the soil to water; and the second is its power of absorbing moisture from the atmosphere. To ascertain the first, it is only required to place an equal weight of different soils in glass tubes of equal diameter, pressing them so that they shall occupy equal spaces, but not filling the tubes; then pour an equal quantity of water over each soil, and place them upright with cups under them. Examine which has the surface first dry, and how much water runs through each in a given time. That which presents a dry surface, while it holds most water in its pores, is probably the best. To ascertain the comparative absorption of moisture, the soils are dried in pairs on a plate of metal heated by steam, or at a heat of 212°, to expel the water; they are then placed in equal quantities in similar flat cups or dishes, and placed in opposite scales of a balance, and poised. The apparatus is exposed to a moist atmosphere out of doors, or in a cellar, and occasionally examined. That which is heaviest is, in general, the most fertile, and contains most humus. If there are more than two soils, they are compared with each other, and with a third as a standard.

"By these simple means any person, however ignorant of chemistry, or unaccustomed to make accurate experiments, may soon satisfy himself as to the comparative value of different soils which have never yet been cultivated; how they may be improved, and what crops are best suited to them: things of the greatest importance to those who go to distant colonies in the hopes of obtaining good land at a moderate price, and cultivating it to advantage.

"But we have intimated that there were other means of ascertaining the mechanical texture of soils than by sifting them; this is by washing with pure water. For this purpose, nothing is required but a few flat plates and large cups. Some of the soil is formed into a very thin mud by stirring it in a cup nearly full of water. The finer particles are successively poured off from the sand or grit, which at last remains pure, so that the water added to it is no longer discoloured: this being dried and weighed, gives the coarse sand. The water and earth poured off are allowed to settle: a common soup-plate is found a very convenient vessel for this purpose. On the surface of the deposited earth will be found all the undecomposed vegetable matter, which, with a little care, is easily taken off, dried, and weighed. The finer portions of the earth can be poured off successively by shaking the whole moderately till nothing but very fine sand remains. The alumina and impalpable silica will remain long suspended in the water, and allow any sand yet remaining to be deposited. They may be rapidly separated from the water by filtration through stout blotting paper; but it is preferable to pour them into a glass tube about one inch in internal diameter, with a cork fitted into the lower end. In this tube the earths slowly fall to the bottom, and any variety in the size of the particles causes a line more or less distinct, which can be observed through the glass; and thus a very good idea may be obtained of the proportion of the different earths as far as regards the size of their particles. For their chemical differences, the preceding process must be adopted.

"It is often useful to ascertain nearly the composition of a soil without having time or opportunity to make accurate experiments. A graduated glass tube which can be carried in the pocket, and a small vial with a ground stopper, containing diluted muriatic acid, and secured in a wooden case for fear of accident, are all the apparatus required. A little of the soil is taken and moistened with water; a few drops of the acid are poured on; and by the greater or less disengagement of bubbles the proportion of calcareous matter is guessed at, and its presence proved. The soil, mixed with water, is poured into the glass tube and well shaken. In a few minutes the coarse sand is deposited, shortly after the finer sand, and, lastly, the clay and impalpable matter, of which the lightest remains longest suspended. Distinct rings can be observed in the deposites, and the graduated tube shows their proportion. A person accustomed to this method will guess with great precision the general qualities of the soil; and when the geological structure of the neighbourhood and the nature of the subsoil are taken into consideration, the value of the land for pasture or cultivation is guessed with little danger of making very glaring mistakes. To surveyors and valuers this method is of very great help, when other means are not at hand.

"In practice, soils are usually divided into light, mellow, and stiff; but this gives very little information, there being every imaginable variety in each of these. In the article *Arable Land*, we have given a more particular classification from Thaer, but this is found chiefly applicable to alluvial soils. There are still minute circumstances which produce great fertility or the reverse, and which it is difficult to investigate. An accurate chemical analysis, joined to a careful mechanical examination, and very correct accounts of the average produce under different systems of cultivation, can alone give us a scale according to which the natural fertility of different soils can be classed; and this must be the work of time and industry joined to science and practical knowledge. We shall therefore conclude this article by recommending to every lover of agriculture to observe and note the peculiarities of the soils with which he is best acquainted; to analyze them frequently and under various circumstances, and thus endeavour to find to what peculiar substance or condition is to be ascribed a greater or less degree of fertility; so as to lead to the simplest and easiest mode of rendering indifferent soils fertile, and increasing the productive power even of the best."—(*Rham.*)

SOILING. "This is the name given in agriculture to the mode of feeding horses and cattle in the stable or yards with food brought to them as it is cut in the meadows or fields. The great advantage of soiling cattle is the increase of manure of the best quality which is thereby produced; and this circumstance alone can counterbalance the great trouble and expense incurred in cutting and carrying all the green food from a distance to the farm-yard.

"The system of soiling is not very generally adopted, it being so much easier to allow the cattle to crop their food in the pastures; but in those countries where property in land is greatly subdivided, and where farms are small and good pastures scarce, as in Flanders, France, and Switzerland, especially where the vineyards render manure scarce and dear by taking a considerable portion of it and returning none, there the soiling of cattle is almost a matter of necessity. A cow or ox requires from two to three acres of pasture or meadow to feed it all the year round, allowing a portion for hay; but by raising clover, lucern, sainfoin, tares, and other green crops, three cows or more can be fed with the produce of one acre, especially if a portion is in turnips or other succulent roots. Thus the straw of the white crops is converted into excellent manure, and the land kept in a state of fertility.

"In proportion as a farm is larger in extent, so the expense of soiling increases, both from the distance of the fields where the green crops grow, and from the same distance to which the dung is to be carted. There is a limit, therefore, to the soiling system, unless there be many yards or stables in different parts of a farm, so as to subdivide it, and make each yard the centre of a distinct system of soiling, with fields near at hand for the green crops. In almost every experiment on a large scale, it has been found that soiling was only a certain mode of purchasing dung, and that it often was more expensive to procure it in this way than to send to a considerable distance to purchase it in towns. Where it cannot be purchased at all, there are no other means, in many situations, of producing a sufficient quantity; and the trouble and expense of soiling must be submitted to. In almost every case where sheep can be folded to feed off the crops, the soiling of cattle is a loss, because the sheep pay something for their food; the cattle in the stall seldom do.

"But there are animals which must be fed for the work of the farm, such as horses or oxen; and these are much more profitably and economically fed by soiling than by any other means. A horse or ox, if he works eight or ten hours, has no time for rest if he has to crop his food from a short pasture, however sweet; whereas an abundant supply of clover, lucern, or tares enables him to take a hearty meal and lie down to rest. He wants no corn with this food. and does his work without losing flesh or activity.

"There is nothing easier in a mild climate, and especially a moist one like Britain or Ireland, than to have a succession of green food from the beginning of spring to the end of autumn. Rye and winter barley, sown early in autumn, will be ready to cut as soon as the mild weather of spring commences; some sown later with winter tares, and the young clover, which has not been cropped in autumn, will succeed. After this come artificial grasses, as Italian rye grass and the grass of water meadows mown early; although this last is not so hearty food for working cattle; but when joined to a mixture of oats and cut straw, their watery nature is corrected. Clover and spring tares (when these can be raised at proper intervals), lucern and sainfoin (if the soil is suited to them), will afford a constant and abundant supply to the scythe which cuts the daily allowance. It is prudent to provide against failure, and have more land in these crops than is absolutely necessary, because the surplus can always be made into hay, or reserved to ripen its seed; and these green crops, valuable as they are, far from deteriorating the soil. clear it of weeds, and render it more fit to bear corn afterward. In this case, soiling is profitable and economical.

"It is generally thought in those countries where the soiling system is most universally adopted, that it is best to allow the green food to remain twelve or twenty-four hours after it is cut before it is given to cattle. This may be prudent with cows and oxen, who are apt to eat voraciously, and are subject to be hoven from the fermentations of the green food in the paunch or rumen; but for horses there is little danger; and if the food is not wet with dew or rain, the fresher it is eaten the better it will nourish the animal, and the more he will relish it.

"If any one is desirous of calculating the expense of soiling any number of beasts, he has only to reckon what time of men and horses it will take to cut the food and carry it to the cattle, from the average distance of the fields in which it can be raised in succession. Much of their time is lost in the morning and evening in going backward and forward from the field to the yard; for there can scarcely be an establishment so large as to keep them employed a whole day; and if there was, the fields must be so large and so distant as to greatly increase the expense of carriage. Not to enter into minute calculations, it is fully proved that, to a certain extent, soiling is profitable and economical, when it can be done before and after the usual hours of labour; but that, when undertaken on a large scale in any one locality, it is usually attended with loss, the manure produced being purchased at too great a price."

SOLANACEÆ. A natural order of herbaceous or shrubby exogens, inhabiting all parts of the world excepting the arctic regions. This order contains nightshade, henbane, mandrake, tobacco, stramonium, the potato, and the tomato, the leaves of all which are narcotic and exciting, but in different degrees, from *Atropa belladonna*, which causes vertigo, convulsions, and vomiting; tobacco, which will frequently produce the first and last of these symptoms; henbane and stramonium, down to some of the solanum tribes, the leaves of which are so inert as to be used as kitchen herbs. Even in the potato plant, the narcotic acrid principle is found in the stem and leaves, and even in the rind of the tuber. But the principal part of the latter consists of starch; and the small quantity of deleterious matter being volatile and near the surface, is readily driven off by the heat used in cooking.

SOLIDUNGULATES. Animals with an undivided hoof, as the horse.

SOLUTION. The diffusion in water or other menstrua of the particles of a solid or other body. The amount dissolved is definite at the same temperature, and is usually increased by heat. A fluid already holding in solution a given substance will not dissolve so much of a third as if pure, and sometimes none at all.

SOOT. "Soot is a complicated and variable mixture of substances produced during the combustion of coal. Its composition, and consequently its effects as a manure, vary with the quality of the coal, with the way in which the coal is burned, and with the height of the chimney in which it is collected.

"Soot has not been analyzed since the year 1826, when a variety examined by Braconnot was found by him to consist, in a thousand parts, of

Ulmic acid? (a substance resembling that portion of the vegetable matter of the soil which is soluble in caustic potash)	302·0
A reddish brown soluble substance, containing nitrogen, and yielding ammonia when heated	200·0
Asboline	5·0
Carbonate of lime, with a trace of magnesia (probably derived in part from the sides of the chimney)	146·6
Acetate of lime	56·5
Sulphate of lime (gypsum)	50·0
Acetate of magnesia	5·3
Phosphate of lime, with a trace of iron	15·0
Chloride of potassium	3·6
Acetate of potash	41·0
Acetate of ammonia	2·0
Silica (sand)	9·5
Charcoal powder	38·5
Water	125·0
	1000·0

"The earthy substances which the soot contains are chiefly derived from the walls of the chimney, and from the ash of the coal, part of which is carried up the chimney by the draught. These, therefore, must be variable, being largest in quantity where the draught is strongest, and where the earthy matter or ash in the coal is the greatest. The quantity of gypsum present depends upon the sulphur contained in the coal: that which is freest from sulphur will give a soot containing the least gypsum. The ammonia and the soluble substance containing nitrogen will vary with the quantity of nitrogen contained in the coal and with certain other causes, so that the composition of different samples of soot may be very unlike, and their influence upon vegetation therefore very unequal. The consequence of this must be, that the results obtained in one spot, or upon one crop, are not to be depended upon as indicative of the *precise* effect which another specimen of soot will produce in another locality, and upon another crop even of the same kind; and thus it happens that the use of soot is more general, and is attended with more beneficial effects in some districts than in others.

"In general, it may be assumed that where ammonia or its salts will benefit the crop, soot also will be of use, and hence its successful application to grass lands. From its containing gypsum, it should also especially benefit the clover crops; yet Dr. Anderson says, 'I have used soot as a top-dressing for clover and rye grass in all proportions, from one hundred bushels per acre to six hundred, and I cannot say that I ever could perceive the clover in the least degree more luxuriant than in the places where no soot had been applied; but upon rye grass its effects are amazing, and increase in proportion to the quantity, so far as my trials have gone;' and his general conclusion is, that *soot does not effect the growth of clover in any way, while it wonderfully promotes that of rye grass.*

"The presence of ammonia in soot causes it, when laid in heaps, to destroy all the plants upon the spot.

"This ammonia also causes soot to injure and diminish the crop in very dry seasons. Thus the produce of a crop of beans, after oats, in 1842, upon an

Unmanured part of the field was . .	29½ bush.
Dressed with four bushels of soot . .	28 "

"It also diminished, in a small degree, the potato.

With manure alone, the produce was	11 tons 17 cwt.
With thirty bushels of soot sprinkled over the dung .	11 " 4 "

"Like rape-dust and saline substances, therefore, soot seems to require moist weather, or a naturally moist soil, to bring out all its virtues.

"Yet even in the dry season of 1842, its effect upon wheat and oats in the same locality (Erskine) was very beneficial. Thus the comparative produce of these crops, when undressed and when top-dressed with ten bushels of soot per acre, was as follows:

Unmanured . . .	Wheat 44	Oats 49
Top-dressed with soot .	" 54	" 55

"But the dressed wheat was inferior in quality to the undressed, the former weighing only 58, the latter 62 pounds a bushel. In the oats there was no difference. Are we to infer from these results that, even in dry seasons, soot may be safely applied to crops of corn, while to pulse and roots it is sure to do no good? Farther precise observations, no doubt, are still necessary, and the more especially, as the experiments upon oats and wheat made in a drier locality gave a decrease in the produce of grain, while in Mr. Fleming's experiments upon turnips, 50 bushels of soot, applied alone, gave an increase of four tons in the crop.

"Another experiment enables us to judge of the efficacy of soot in a dry season, compared with that of nitrate of soda and of guano, upon the produce of hay. Thus the crop of hay per acre from the

	tons.	cwts.	Cost. £.	s.	d.
Undressed portion, weighed .	1	8	——		
Dressed with 40 bush. of soot .	1	15	0	11	8
" " 160 lbs. nitr. of soda	1	19	1	15	9
" " 160 lbs. of guano .	2	2	1	15	9

"In this experiment the soot proved a more profitable application than either of the other manures.

"In regard to this substance, I shall only advert to one other observation—but it is an important one—made by Mr. Morton, when describing the management of a well-conducted farm. 'The quantity of soot used upon this farm amounts to 3000 bushels a year, one half of which is applied to the potato, the other half to the wheat crop.' *All the straw grown upon this farm is sold for thatch*, and for the last thirty years the only manure that has been purchased to replace this straw is soot."—(*Johnston.*)

The amount applied is from twenty-five to forty bushels the acre.

SOPORIFICS. Drugs which produce sleep.

SOREDIA. Masses of powdery bodies lying on the thallus of lichens.

SORI. The small heaps of reproductive granules found growing upon the fronds of polypodiaceous ferns.

SOROSIS. A fruit resembling the mulberry, being a succulent spike.

SORREL. *Rumex acetosella.* A small perennial weed of the dock family, with a sour taste, arising from the binoxalate of potash. It grows on poor lands, and marks sterility. A good liming and tilth are wanting to improve such soils, not because they are sour, or the sorrel should be killed. but because they are poor lands. The wood (*oxalis*) sorrel grows only in rich places.

SORREL-TREE. *Andromeda arborea.* A handsome shrubbery tree in the North, with beautiful white racemes of flowers. In the South it becomes a large tree.

SOUTHERNWOOD. Wormwood.

SOWENS. A dish made from oatmeal.

SOWING, AND SOWING MACHINES. "The sowing of the seed has always been looked upon as one of the most important operations of husbandry. Much of the success of the future crops depends on the time and the mode in which the seed is committed to the earth. After the land has been well prepared by judicious tillage and manuring, many accidents and circumstances may disappoint the hope of the farmer, and the crop may be scanty or fail altogether. The weather and the seasons are not under his control; but much also depends on his own judgment and skill. If he selects the best seeds, chooses the proper season for sowing them, and has them carefully distributed and properly covered with earth, as their nature requires for the most perfect germination, and thus also protects them from the voracity of birds or insects, he will have a much greater prospect of success, under all circumstances, than if he were careless or negligent.

"The most common mode of sowing the seed is by scattering it as evenly as possible over the ploughed surface, as it lies in ridges from the plough. The harrows follow, and crumbling down the ridges, cover the seed which has fallen in the hollows between them. It requires an experienced sower to scatter the exact quantity over a given surface, without crowding the seed in one spot, and allowing too great intervals in another. Hence the farmer who does not himself sow the seed, invariably chooses the most experienced and skilful labourer to perform this work. Notwithstanding every care and attention on the part of the farmer, the labourer will often relax and become careless, and the result appears only when it is too late to remedy it. This has given rise to the various attempts which have been made to invent machines for sowing the seed, such as should ensure perfect regularity. Of some of these we will now give a short account.

"One of the simplest of these machines consisted in a hollow cylinder, with one or more rows of holes in a line parallel to the axis. These holes can be stopped in part, if required. The seed is put into the cylinder, the length of which is equal to the width of the land, or stitch, which it is desired to sow at a time. By shaking this when held horizontally and at right angles to the path of the sower, the seed is scattered with considerable regularity. One inconvenience of this instrument is, that it requires to be filled frequently, and that much still depends on the attention of the operator. Accordingly, it was very soon laid by. The idea, however, was followed up and improved upon in the *sowing barrow*, an instrument still extensively used for sowing grass seeds. It consists of a wooden trough placed on the frame of a light wheelbarrow. An iron spindle, furnished with circular brushes at regular intervals, runs the whole length of the trough, and is turned by means of simple machinery connected with the wheel. Opposite each brush is a brass plate, with holes of different sizes, which can be partly closed by means of a circular slide. According to the size of the seed to be sown and the quantity to be scattered, the holes are opened or shut. The seed is put into the trough, which has a cover or lid; and by merely wheeling the barrow in a straight line, a breadth is sown equal to the length of the trough, usually 12 or 15 feet. But this machine cannot conveniently be used in windy weather, which disperses the seeds irregularly; and it is very little superior to sowing by the hand, except in the case of small seeds, which cannot so well be spread evenly by the hand.

"The drill husbandry has suggested other more complicated machines, of which some account will be found in the article *Drill*. The principle of these is to deliver the seed by means of funnels, each corresponding to a small furrow made by a coulter placed immediately before the funnel; and some of these machines perform the work very regularly and satisfactorily. As the inequalities of the ground require that the coulters should move up or down, to allow for these inequalities, the seed cannot be accurately deposited at a given depth; and some improvement in the mode of drilling is yet desirable, and has, in some measure, been effected. The patent lever drill in common use is very imperfect in its work, and the remedy lies in the greater attention to the preparation of the surface. When this is effected, the levers may be set aside, and a much simpler drill, such as was used at first, may replace it. The object is to make furrows of equal depth in which to deposite the seed, and to cover this uniformly. The land must consequently be more carefully prepared by repeated harrowing and rolling, till the surface resembles the seed-beds in a garden. A simple drill, which makes equidistant furrows at a given depth, in which the seed drops regularly, will then do better work than a more complicated machine; but if still greater accuracy and perfection are desired, the dibble must be had recourse to. No one will deny that seed deposited by means of a dibble is distributed more equally and covered with a more equal depth of soil than by any other means, and that there is a great economy of seed in this mode of sowing; but the slowness of the operation, and the number of hands it would require to dibble all the seed on a large farm, have prevented its being very generally adopted. See *Arable Land*. Many attempts have been made to invent machines to imitate the work done by hand in dibbling, and hitherto with no marked success, owing chiefly to the difficulty of clearing the dibbles from the adhering soil, and making a clean hole, and also of letting the seed fall exactly in the dibble holes. Several patents have lately been taken out for dibbling machines, of which we shall only notice three. The first machine consists of large hollow disks, armed at the circumference with blunt projections or knobs, which make a depression in the surface as the disk revolves: these knobs are hollow, and open by one half sliding upward as the knob leaves the depression it has made. The seed which has been deposited in the hollow knob falls into the hole. This machine is said to do its work well.

"The next is Bradshaw's patent, which is not so generally known, having only been tried by the inventor and his friends. Here the dibbles are moved up and down by means of a crank, or eccentric circle, and are twisted in the ground by means of a projection from the shank of the dibble, which is connected with the frame of the machine; and when the dibble is moved by the crank, the rod is twisted by the difference in the motion of the crank and the machine. The seed is delivered by means of a cylinder with cavities in its surface, which revolves very near the ground, the seed being kept in these cavities by a leather belt, which only lets them out at the lowest part.

"The last is somewhat on the same principle, and was invented by the late Rev. W. L. Rham. This machine, which was exhibited at the meeting of the Royal Agricultural Society of England at Liverpool, in 1841, is thus noticed by the judges of the implements appointed by that Society:

"'The Rev. W. L. Rham exhibited an implement, the principal object of which is to extend and improve the system of drilling and dibbling wheat, beans, &c. It is chiefly in its latter capacity, as a dibbler of seed and manure, that we shall attempt to give a slight description of it. The operative part of the machine is suspended upon an iron carriage having four wheels, the two hinder ones being fast upon their axle and turning with it. On this axle is a spur-wheel, giving motion to a pinion on an intermediary axle, which carries a wheel geared into a second pinion fixed on its axis, having six cranks arranged spirally. The velocity given to the axis is such that the cranks make one revolution for every six inches of the circumference of the hind wheels, or whatever is the distance desired between dibble holes. The radius of each crank is such that this distance shall be equal to the circumference described by one revolution. Thus the space described by every crank coincides with that passed over in the same time by the hind wheels; and as the cranks turn, during the half of a revolution, in an opposite direction to that of the wheels, the result of this compound motion is a pause or rest of short duration, at the point where the crank in its rotation commences to retrograde from the line of progress of the machine, *i. e.*, at the lowest point, and when the dibbles are in the ground. The crank raises the dibbles up and down by means of connecting rods and levers, which double the vertical without increasing the horizontal motion; and in order that the point when in the ground may be perfectly stationary, it is made the centre of motion while the machine progresses; and to enable it to retain that position for a sufficient length of time, for the purpose of leaving a hole truly vertical, the dibbles move between checks in the rod which connects it with the crank, and which has a spring to restore it quickly to its proper place as it rises out of the ground. During, therefore, the entire time occupied in its piercing the hole and being withdrawn from the soil, the dibble retains its perpendicularity.

"'By an ingenious and simple contrivance, a slow rotatory motion about its own axis is given to the dibble, by which means its point may be said to *bore* into the ground, thus assisting in the formation of the hole; and by the same action the dibble is cleared of any adhering soil, and the hole left firm and clear.

"'The seed-valve consists of a cylinder, with a cavity in it of dimensions sufficient to hold one or more seeds. This cylinder is *tumbled* over, and the seed discharged into a recipient of the shape of a quadrant, from which it is *pushed out*, when the cylinder returns to its first position and takes in a fresh supply. As this motion is sudden, the seed is surely delivered, even when rather damp: when the cylinder is delivering, the quadrant is receiving, and *vice versa*. The delivery of manure is effected by a similar apparatus, only of a larger size, the valves being furnished with brushes, or other means, to remove the superfluity.

"'The valves are connected with the dibbles in such a manner as to deposite the manure and seed in the hole last formed, while the dibbles are stationary in the advancing one. The dibbles bore their holes in shallow drills made by the pressure and sliding action of an iron shoe shaped like a boat, and forming a smooth furrow.

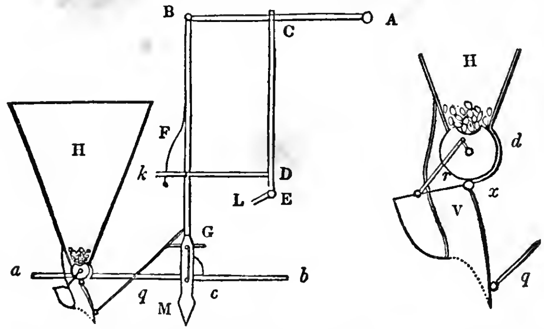
"'The whole of the machinery is supported by an iron frame, one end of which rests on trunnions attached to a projecting part of the back of the carriage. It is suspended at the other end by a cross shaft, carrying two pinions, working in arcs of circles fixed on the frame, so that it can be raised or depressed at pleasure, or elevated clear of the ground by one turn of a winch. At the same time, the pinion connecting the machinery with the hind wheels is put out of gear, and the whole can be moved about on the carriage.

"'The object of the reverend gentleman in contriving this original and singularly ingenious implement, has been to imitate the more minute and certain manipulations of the gardener, and so to adapt his machinery to the drilling and dibbling of seed upon land previously laid flat and well prepared, that every field, however extensive, should present the neatness and regularity of a highly finished garden.

"'The distinguishing peculiarities of this remarkable piece of mechanism are the arrangements for the dibbles to *bore* holes, causing them to be perpendicular and truly cylindrical, and the apparatus for giving certainty to the valves in receiving and delivering the manure.'

"In order to render the above highly commendatory report of the judges more intelligible to those who have not seen this implement, we will add a slight diagram, to explain the most essential parts:

"A C B is a lever, whose fulcrum is at A; B G, the rod of the dibble M, which turns on it by means of a socket; C D E is the rod which communicates the motion to the lever A C B, by means of the crank L E, moved by the machinery. *k* D is a rod connecting the crank with the rod of the dibble, and having a slit or cheeks in which this rod moves. F is the spring which keeps the rod in its place when the dibble is out of the ground. *a b* is an iron plate with a slit or cheeks to keep the dibble from swerving from the line of the furrow made by the shoe. *c* is a thin pin projecting upward from this plate, and bent at its upper end. This pin meets one of four arms projecting horizontally from the shank of the dibble whenever it descends into the ground; and as it proceeds with the carriage while the dibble is at rest, it gives this a motion round its rod to the extent of a quarter of a circle. When the rod rises, it clears the arms from the pin, which, at the next



descent, meets with another arm; and thus a complete revolution is effected in four descents of the dibble.

"H is the vessel which contains the seed. The valve consists of a cylinder, *d*, with a cavity sufficient to receive the required number of seeds to be deposited in each hole, a brush to remove any superfluous seeds, and a recipient, V, in the form of a quadrant, in which they drop when the cylinder is suddenly turned half round on its axis. This is effected by a small crank fixed to the axis, and connected by a rod *r* with the quadrant V. The quadrant itself moves a quarter round its centre *x* by means of a rod *q*, which connects it with the dibble, or with the crank when the dibble is not used; and the seed is dropped into the dibble hole or the furrow when the quadrant is pushed back in its place. A rake and roller are attached to the implement to complete the operation.

"This may give some idea of this new machine, and if it answer the expectations of the inventor, it will cause a great saving in the seed and labour of sowing, while it will deposite the seed much more regularly, and at an equal depth."

SOW THISTLES. Composite plants of the genus *Sonchus*. They are smooth perennials, with a milky juice.

SPADE. A well-known garden implement. The spading of land produces the best results from the thorough loosening and great depth to which the soil is stirred. Astonishing crops have been obtained on small lots by using the spade for wheat and root culture; but the expense is the great drawback.

SPADIX. A form of inflorescence, in which the flowers are arranged around a fleshy rachis, and enclosed within a kind of bract called a spathe, as in palms and araceous plants. The Indian turnip is an instance.

SPANISH NEEDLES. Annual weeds of the genus *Bidens*, the seeds of which adhere to the skin of animals and clothes.

SPAN WORMS. The caterpillars called geometers, loopers, or cankerworms. See *Canker-worm*. The female of the prefect insects are incapable of flight, and crawl up trees to lay their eggs; various contrivances have, therefore, been adopted to hinder them passing, such as a rope of straw bound round the trunk, a layer of tar spread on paper and fastened round, or lead and tin troughs containing oil, water, or other preparations, have been affixed to the trunk with great advantage.

SPASM. A cramp. Rubbing the skin with turpentine, when it is of the external muscles, often alleviates the pain.

SPATHE. See *Spadix*.

SPAVIN. See *Horse, Diseases of*.

SPAYING. The operation of extracting the ovaries of the females of different kinds of animals, as sows, heifers, mares, &c., in order to prevent any future conception, and promote fattening.

SPEAR GRASS. A name given to the *Poa pratensis*.

SPEARMINT. Common green mint: also the weed *Mentha tenuis*.

SPECIES. In natural history, an individual separated from others of a genus by certain slight but permanent characters.

SPECIFIC GRAVITY. See *Gravity*.

SPECTRUM. An image, usually applied to the image of the sun seen through a prism, and which consists of seven colours.

SPECULUM. A reflector or mirror of metal.

SPEEDWELL. The genus *Veronica*, perennial plants, often with beautiful spikes of blue flowers.

SPELT. Spelter wheat. See *Wheat*.

SPERMATIC ANIMALCULES. Minute, thread-like animalcules found in the secretion of the testes.

SPERMATIC CORD. The collection of blood-vessels passing from the abdomen to the testes.

SPERMIDIUM. The same as akenium, a small seed vessel resembling a seed.

SPHACELUS. Mortification, gangrene.

SPHAGNUM. A genus of mosses growing in bogs, and forming a great deal of the peat.

SPHENOID BONE. A bone in the base of the skull.

SPHINCTER (from σφιγχω, *I close*). The name of muscles which close the natural openings of the body.

SPICE WOOD, or BUSH. *Laurus benzoin*. Benjamin bush, fever bush. An indigenous shrub, four to ten feet high, the wood of which yields an aromatic smell. It grows on damp places.

SPIGEL. Fennel.

SPIKE. An inflorescence, in which the flowers are sessile upon an upright stem.

SPINACH. *Spinacia oleracea*. An annual of the family *Chenopodiaceæ*. Varieties: Large round-leaved, broad-leaved Savoy, Holland. The New Zealand, which is a superior vegetable, is very large and running: it is the *Tetragona expansa*. The seeds are planted in hills six feet apart, three to the hill, in May: twenty hills supply a family.

"The soil requires to be rich to produce large, fine leaves, though spinach will grow even in the poorest soil, if well manured. The time of sowing for a winter crop, to come in from March till May, is from the middle of August to the 8th of September; but if frost occurs soon after the latter sowing, it will seldom survive the winter. For a summer crop, to come in after the winter crop has run to seed, the end of April is the proper time; though, if an August sowing have been neglected, seed may be sown in the end of February or even in January. When sown in June and July, it will run rapidly to seed.

"The sorts are the prickly-seeded, or, what is better, the Holland, for the August sowing, and the round-leaved for spring.

"For a bed five feet wide and twelve feet long, an ounce of seed will be enough, or half an ounce for the same space drilled.

"Sow thinly broad-cast in a finely-dug bed, or, rather, in very shallow drills six or eight inches apart; or, as some prefer, double that distance, with rows of radishes or lettuce between, treading it well before raking. The earth over the seed should not exceed the third of an inch, for if much thicker, the seed will be lost.

"Sparrows and other birds, if not prevented, will endeavour to purloin the whole sowing, as has frequently occurred within our knowledge; and when the young plants come up, pigeons, if they get at them, will devour the whole. Careful weeding and hoeing up the earth, so as not to choke the hearts of the plants, are indispensable. Thinning also must be duly attended to, and the plants should be left three or four inches apart. If a few plants of the winter or spring crops are allowed to remain, they will produce an abundance of seed, which should be protected from birds. For summer crops, it is a good plan to sow the seed in drills, between the rows of pease, as the latter will afford it shelter and shade, and assist much in preventing it from running to seed; besides which, the ground will thus be better and more profitably occupied.

"*White beet* of the curled sort, and several wild plants and weeds, such as *Good King Henry, goosefoot*, or *myles*, yield leaves little inferior to spinach."

SPINDLE. The axis of a wheel or roller.

SPINDLE-SHAPED, FUSIFORM. Roots are so called which taper at both ends, as the radish.

SPINDLE-TREE. *Euonymus Europæus.* A small tree or shrub, the wood of which is extremely hard, and used for spindles. It is improperly called strawberry-tree by some nursery men.

SPINDLE WORM. The caterpillar which destroys the young ear of corn, *Gortyna Zeæ* of Harris: they make known their presence by leaving a small hole on the shuck, and should be destroyed when found, as they hinder the formation of the ear. See *Corn, Diseases of.* The moth is thus described by Dr. Harris:

"The fore wings are rust-red; they are mottled with gray, almost in bands, uniting with the ordinary spots, which are also gray and indistinct; there is an irregular tawny spot near the tip, and on the veins there are a few black dots. The hind wings are yellowish-gray, with a central dusky spot, behind which are two faint, dusky bands. The head and thorax are rust-red, with an elevated tawny tuft on each. The abdomen is pale-brown, with a row of tawny tufts on the back. The wings expand nearly one inch and a half."

SPINE. The vertebrated column of quadrupeds. It is composed of forty or more pieces, or *vertebræ*, articulated by cartilage; through these runs the spinal marrow, or pith, which sends off at every bone a pair of spinal nerves, which distribute the sensation of touch and the power of movement to the skin and muscles, over which they are distributed.

SPINES. In botany, imperfect branches.

SPIRACLES. The breathing openings or pores of insects.

SPIRAL VESSELS. In plants, elongated cellules, which contain a delicate internal thread, spirally wound, and capable of being drawn out.

SPIRIT. A distilled alcoholic product.

SPIT OF EARTH. A spadeful, as dug from the soil.

SPLANCHNOLOGY (from σπλαγνον, *an entrail*). An account of the viscera.

SPLAYED. In building, an angle cut off obliquely.

SPLEEN. "A spongy viscus, of an oval form, the use of which is unknown; placed in the human subject in the left hypochondrium, between the eleventh and twelfth false ribs."

SPLINT. "In farriery, a hard excrescence growing on the shank bones of horses. It appears first in the form of a callous tumour, and afterward ossifies. If the splint interfere with the action of some tendon or ligament, the hair should be removed, a little strong mercurial ointment be rubbed in for two days, and then an active blister applied." Also, a thin board of a suitable figure, or pasteboard, to sustain a broken limb.

SPONGIOLE. The small spongy extremity of the rootlets.

SPORADIC. Springing up singly, or in small numbers. Diseases are sporadic which are not epidemic or endemic.

SPORANGIUM. The case or receptacle containing the spores.

SPORIDIA. The covering of the spores, the spore-like bodies of algæ.

SPORULES, or SPORES. The minute, simple, reproductive grains of cryptogamic plants.

SPRINGS. Natural fountains of water, formed wherever the rain, falling on a pervious bed, is interrupted by an impervious stratum of clay or rock. See *Drainage*.

SPRAY. The young branches or twigs of trees.

SPRUCE PINE. *Pinus Canadensis*. Hemlock pine, a handsome evergreen tree, with excellent wood. It is common in New-York and the Eastern States. The bark is used for tanning.

SPUD. "An implement used advantageously in cutting up weeds. It consists of a chisel-formed tool, about two inches wide on the cutting edge, inserted into a handle of some four or six feet in length. It is often made use of by the farmer as a useful substitute for the walking-cane, affording an opportunity of destroying weeds with the utmost facility while walking over his grounds."

SPUR. The short, fruit-bearing branches of apples and pears. The hind toe of gallinaceous birds. A well-known implement used by horsemen. In botany, an elongated appendage of the corolla.

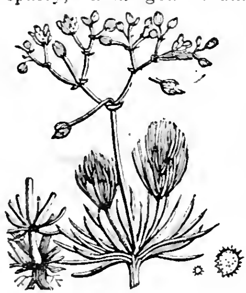
SPURRED RYE. Ergotted rye. See *Ergot*.

SPURGE. The genus *Euphorbia*, the juice of which is usually acrid. Many species are highly ornamental. The unripe fruit of the *E. lathyris* is used as a pickle.

SPURGE LAUREL. *Daphne laureola*. A shrub of the same genus as the *Mezereon*.

SPUR OF RYE. Ergot. See *Rye*.

SPURRY. *Spergula arvensis* (*fig.*). Corn spurry, an indigenous annual,



growing in sandy wheat and grain fields. It may be cultivated on the poorest soils, and is so quick of growth and short of duration, that it is often made to take an intermediate place between the harvest and the spring sowing, without any strict adherence to the regularity of succession. It is sown sometimes in the spring, but in general in the autumn, immediately after harvesting the corn crops. One light ploughing is sufficient, and as the grain is very small, it is but very lightly covered. About twenty-four pounds of seed to the acre is the usual quantity. Its growth is so rapid that in five or six weeks it acquires its full height, which seldom exceeds twelve or fourteen inches. The crop is of course a light one, but is considered of great value, both as supplying a certain quantum of provender at very little cost, and as being the best food for milch cows to improve the quality of the butter. It lasts till the frost sets in, and is usually fed off by milch cows tethered on it, but is sometimes cut and carried to the stalls.

Where spurry is sown in spring, the crop is occasionally made into hay; but from the watery nature of the plant, it shrinks very much in bulk, and, upon the whole, is much more advantageously consumed in the other manner. It is indigenous in Flanders; and, except when cultivated, is looked on as a weed, as in this country.

Von Thaer considers it the most nutritious herb of any, but the crop is too small. Crome makes the fresh plants to consist of water, 71·0; starch, sugar, and gum, 7·5; albumen, 2·3; woody fibre, 12·0 per cent.

SQUAMA. A scale: rudimentary scale, like leaves or other parts of a plant. *Squamous* is scaly, or scale-like.

SQUARROUS. Ragged in appearance.

SQUASH. *Cucurbita melopepa* is the simbling or round squash; *C. verrucosa*, wharty squash; the vegetable marrow, *C. succado*. Varieties: Early orange, early bush scollop, green-striped bush, early crookneck, large cushaw, vegetable or autumn marrow, Canada or winter crookneck, Lima cocoanut, acorn or California, and Valparaiso. Of these, the early orange and autumn marrow are best for the table; the Valparaiso, which sometimes becomes upward of 100 lbs. weight, is also excellent for the table and a crop. The Canada or winter crookneck keeps well through winter, and is good for a crop for cattle. The culture is the same as for the cucumber and melon, the hills being from six to ten feet, according to the variety. They should be well aired and dry before being put away for winter, and should be placed on straw or shelves, and not allowed to press on each other.

SQUASH BUG. *Coreus tristis.* See *Cucumber.*

SQUEAKERS. Pigeons under six months old.

SQUILL. The genus *Scilla*. Bulbous plants with handsome flowers like the hyacinth. The root of *S. maritima*, a native of the sandy shores of the Mediterranean, is an excellent medicine in diseases of the throat and chest; it is also diuretic.

STABLE. The building in which horses are lodged. It should be well ventilated and often cleaned, the urine and dung being collected into a suitable tank, or charcoal and gypsum should be spread on the floor to catch the urine and improve the air. The following account of stable management is from the "British Husbandry:"

"Notwithstanding that the cost of horses forms a prominent item in the farmer's outlay, there is frequently no part of his live-stock, nor any branch of his business, either so ill understood or so much neglected as *stable management*. Let any one look into the low-roofed, narrow, dark, and unstalled building in which teams are often huddled together in some of the old homesteads, and the fumes arising from stagnant urine lying upon the uneven pavement, as well as from accumulated heaps of fermenting litter, and he must be convinced that it is a place as noxious to health as the cobwebbed rafters, the unwhitewashed walls, and the confusion of the harness and utensils, show it to be devoid of neatness and order. Let him examine the horses, and he will find that, although perhaps sleek from good feeding, their coats are foul and their heels greasy. Instead of exhibiting the sprightly appearance indicated by animals that have been comfortably bedded, their heavy eyes and sluggish appearance distinctly mark the state of the stable they have quitted. But though this description is strictly applicable to many stables, it must yet be admitted that those on most farms of magnitude wear a very different appearance.

"A stable for farm horses need not be rigged out like one for hunters; but it should be roomy, clean, and well ventilated, and everything belonging to it should be kept in its proper place. Neither is it necessary that it should be completely stalled: team cattle are generally quiet; if vicious, they should be got rid of. A pair of horses, worked together, will stand and feed together quite as conveniently as in separate stalls, if allowed sufficient room, and two in one stall are more convenient to the carter. Horses gather their feet under them; and 5 feet, or 4½ feet if the cattle be not large, are sufficient width for the fore quarter. A division between each pair is, however, desirable; but a strong post and rail will be sufficient, without close boarding, provided a partition be made about four feet long, and extending from thence upward at least the full depth of the manger, so as to enclose both that and the rack. Horses, however, sometimes acquire a habit of not lying down at all in the stable, if they be not very conveniently lodged; and as this cannot but prove highly prejudicial to their health, they should, in such cases, be accommodated with roomy single stalls, or else turned out under a loose shed. Double stables, in which horses stand heel to heel, are objectionable; and hay is better when cut fresh daily from the stack, as well as more economically used, than when kept in lofts. Corner racks are preferable to those which extend along the front; and if bars be nailed across the manger, at about a foot distance from each other, they will prevent the horses from throwing out their food, which they are apt to do, in search of the corn, when it is mixed with chaff, as well as when they have filled themselves. Every kind of food should, also, be administered in small quantities at a time; when manger meat is given, and even when racked up for the night, the provender should be served out sparingly. A cart horse, fed on dry food, will require from two to three hours to consume his morning feed; the men should therefore be early in the stable, and all food should be punctually given at stated hours. Regularity should also be observed in the hours of their work. A farm horse can well support ten hours' labour in the day, provided he be not hurried, and the time be divided into two equal periods, with a rest of at least two or three hours between. In the short days of winter, when that cannot be allowed, the time may be prolonged to six or even seven hours, but ought never to extend beyond eight, with a short bait.

"Care is also requisite in watering horses in the stable; and it should never be given either immediately before or after their corn, unless they first eat some hay. On the road they may be watered moderately, and then put gently into motion, instead of allowing them to stand at an alehouse door while the carter refreshes himself. Some persons imagine that hard spring water is the most wholesome for cattle, but horses invariably prefer it soft.

"*Farm stables* are merely intended to protect the cattle from the weather, for, being much exposed to changes of the temperature, they should never be kept hot; and as fresh air is an essential element of health, the windows should be merely latticed, like those in granaries; and two or three wooden funnels, according to the size of the stable, should be inserted from the ceiling through the roof, thus forming so many chimneys for the escape of foul vapours. The floors of all stables should be paved with either clinkers or table-stones, laid close and even, and well bedded under the foundation, as otherwise a portion of the urine will be absorbed by the soil, and will emit a nauseous and unwholesome exhalation. The floor should be slightly raised at the front of the stalls, but the slope should not exceed three inches, and that should be provided for by raising the litter behind them, or they will stand in an uneasy position. The doors would be more conveniently placed at one end of the stable than in the side, as the dung will be more easily removed, and a free passage may be allowed to the urine by a gentle slant in the gutter of the pavement at their feet, which may then be conveniently carried off by a drain.

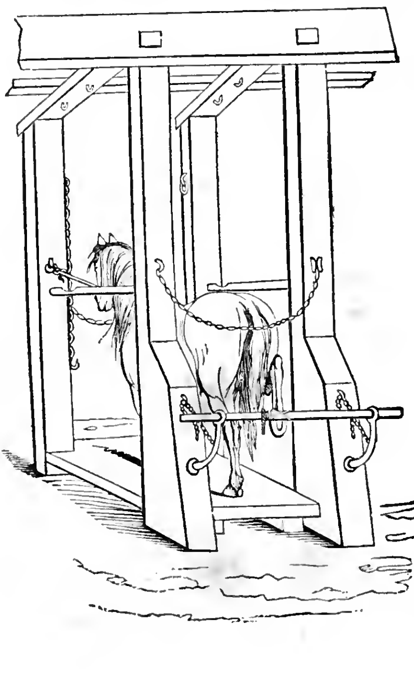
"Some very intelligent farmers keep their teams entirely in open yards, or *hammels*, surrounded with well littered sheds for them to run under at pleasure; and experience has proved that, in this manner, their health may be maintained as well, if not better than in stables. Such a yard does for the whole year—for summer soiling and winter feeding—but it is attended with the inconvenience of exposing them to accidents when many are thus together; neither can their food be so equally divided, nor can they be kept equally clean.

"*Carters* think it no harm to pilfer corn to pamper their teams; they have no idea of any better mode of feeding than to cram them to the utmost, and, if allowed the free use of hay, they will not only waste it, but, out of mistaken kindness, do the animals serious injury by overloading their stomachs. On every consideration, therefore, of health and economy, they should be allowanced. The chaff, as well as the corn, should be weighed or measured, and if hay be given in the racks, it should be bound, and given out in trusses: the expense of binding will be more than repaid by the saving in consumption. Marshall has justly observed, in his Minutes of Agriculture, that, by stinting the quantity, the men become more careful; they look upon it as something, and know that if they lavish to-day they will want to-morrow; thus the servant learns frugality, while his cattle have their food regularly: he will give them a little at a time, and see that they eat it up clean. There is a sympathy between the human and the brute creation, arising from acquaintance, which is more easily observed than communicated. There are carters who would sooner starve themselves than their horses, and among stock-feeders in general it is obvious to common observation; though this kindness does not extend equally to the bestowal of their labour, and, from habit, as well as idleness, they are very generally neglectful of the essential duties of cleanliness. Much of this must, however, be attributed to their masters, who too commonly treat them as men not to be trusted, and suspicion naturally begets deceit. There is, consequently, but little sympathy existing between them; but when servants are used with kindness, they often return it with interest, and devote themselves with sincerity to the service of their employer.

"*Condition* is a word of large meaning in the stable of a gentleman; in that of a farmer, whose horses should be kept more for work than for show, it should be understood to mean a sufficiency of wholesome food, evidenced by a healthy, mellow, clean-skinned hide, without much fat, a lively eye, and a general appearance of health. Common working horses require but little grooming; yet their coats should be kept clear of scurf, and their feet should be well attended to. The rough hair which encumbers their fetlocks is useful in some countries as a protection against flints, but a much less quantity would serve that purpose, and when allowed to remain clogged with dirt, it engenders grease. Through a very unwise economy of some masters, the shoes, too, are seldom removed until they are either completely worn or broken, by which much injury is done to the hoof; their shoulders are galled by want of timely attention to the state of the collars, and time is continually lost by the breaking and patching of the harness. In all these cases, prevention is better than cure; and, besides the established regulation of removing the dung and 'setting the stable fair' every morning, as well as seeing that each horse be thoroughly dry and clean, his feet washed, and occasionally oiled and stopped, before 'making up for the night,' it would be a good rule to have a regular inspection of the cattle, harness, and implements, once every week, even were a portion of the Saturday evening's usual work devoted to that purpose.

"*Shoeing.* — Although the better class of veterinary surgeons are men of education, it is yet to be regretted that the common run of farriers are of a very different description, who, though usually employed in common cases, yet should never be intrusted in one that incurs danger. They, however, are generally handy workmen, and possessed of knowledge and observation sufficient to shoe a horse with propriety, though it is often an operation which requires considerable delicacy, and, in the commonest case, should never be confided to a man who is not perfectly master of his business. Though usually executed through the general docility of the animals, without any extraordinary difficulty, yet there is no one who has not witnessed repeated instances of accidents to both men and horses, through the violence or the imperfect performance of the operation, through the unsteadiness of the latter; and it even sometimes becomes necessary to cast them, in order to avoid danger, from the want of a proper machine for the purpose of security.

"This difficulty may, however, be avoided by the adoption of the Flemish forge, which is in general use throughout the Low Countries, and consists of strong posts and rails, by



which the horses are confined in a very simple apparatus, which may be easily erected, and which we partly copy from one of the plates in the work of Count Lasteyrie on agricultural implements."

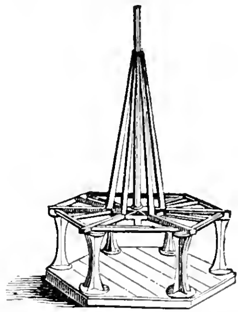
STACK. A regular structure of hay, oats, wheat, or other produce, for their storage and preservation.

"*Stands* are requisite fixtures of the stack-yard: they are basements of timber, or masonry, or sometimes of iron, on which to build the stack, and their object is to keep the lower part of the stack dry and exclude vermin. The usual mode of constructing stands is to place a stout frame of timber on upright stones, two feet high, and having projecting caps of flat stones. They are also constructed wholly of stone, with circular or polygonal walls (*Fig.* 1, *a*, *b*), built to

Fig. 1.

the same height as in the former case, in a rather slanting manner outward, and covered on the tops with copings of oak planking, or flat stones, which project over the edges several inches, and in that way prevent the ascent of rats and mice to the stacks. In both these modes, pieces of timber are placed as a frame in the middle to support the grain upon, and generally a cone of spars in the centre, to form a column of air in the heart of the corn. Some suppose the first of these sorts of corn stands to be the best for general purposes, as being more easily as well as more cheaply constructed, and, at the same time, permitting the air to enter and circulate with more freedom underneath, in the bottom of the stand, which is of much advantage. It is obvious that the form of these stands or basements must vary according to that in which the stacks are to be made, which is different in different districts. But wherever the thrashing machine is introduced, the circular base, as producing a stack of a moderate size, with other advantages, is generally preferred. But cast-iron stands (*Fig.* 2), with or without fun-

Fig. 2.



nels, are found preferable, and admit of stacking the corn somewhat earlier. The pillars of these stands are three feet high, and weigh half a hundred each. A stack requires seven pillars, besides the framing, which may either be made of poles or young trees. In the wet climate of Clackmannanshire, wheat has been stacked in five days, beans in eight, and barley and oats in ten days, and sometimes earlier. No vermin can find their way into these stacks to consume the grain, and the straw is better preserved. The cone or triangle keeps up a circulation of air, and prevents heating or other damage.

"The stack-yard, or enclosure, within which corn, hay, &c., are stacked, is placed exterior to that side of the building which contains the barn. Stack-yards should always be sufficiently spacious and airy, having a firm, dry bottom; and some advise them to be ridged up to prevent the accumulation of surface water; as by raising the ridges pretty well in the middle, and covering the places where the stacks are to be built, either with rough stones, with a mixture of gravel, or with pavement in the same manner as streets, much advantage would be gained at little expense; but a much better method is to have them raised considerably above the surface, and placed upon pillars of wood or stone, with a covering of wood round the circumference, and beams laid across. The enclosing of stack-yards should be well performed, either by means of walls or palings, or, better, with a sunk fence; as in this way the stacks will have the full benefit of the air from top to bottom, a circumstance of no small moment, since it is often found, especially in wet seasons, where the fence of the stack-yards is only a low wall, that the whole of the stacks are damaged or spoiled as high up as the wall reaches, while the upper part is perfectly safe. Should any addition be required to the sunk fence, a railing upon the top may be quite sufficient. This fully shows the vast advantage of having stack-yards sufficiently airy. The proper arrangement of the stands, for their being removed to the thrashing-mill, is also a matter of much consequence in the economy of the work that is to be performed in them.

"The proper size of the hay stack should probably be different in some degree, according to the state and nature of the hay; but a middling size is perhaps the best, say from twenty to thirty loads of about one ton each, as there are inconveniences in both small and large stacks, the former having too much outside, while the latter are liable to take on too much heat, and, at the same time, permit less moisture to be preserved in the hay. In small stacks, the bellying forms, with very narrow bottoms, have often much advantage, and are, in some districts, termed sheep stacks, probably from the slovenly practice of sheep having been permitted to feed at them.

"In building every description of stack, the stem, or body, should be so formed as to swell gradually outward, quite up to the part termed the eaves; as by this method it is more perfectly secured against the entrance of moisture, and, at the same time, requires a less space of stand to rest upon; and, when the building of them is well performed, they have equal solidity, and stand in as firm a manner.

"The stem should contain about two thirds, and the roof one third, of the whole stack. If it be built on a frame, the stem should contain less and the roof more; if on a bottom, the reverse. The corners of the stem should not be built too sharp, but should be carried up rather roundish, by which the sides will look fuller, and the swell given by the pressure will be more perceptible.

"The ends of the roof should have a gentle projection, answerable to the stem; and the sides should be carried up rather convex than flat or concave. Perhaps a roof gently convex shoots off the rains better than any other.

"Where grain is stacked that has not been sheaved, and in building hay stacks, it is the usual practice to have a number of persons upon the stack, the corn or hay being forked up and deposited on the different sides all round in a similar method; after this, other parcels are laid all round on the inside of these, so as to bind them in a secure manner from slipping outward, the operator proceeding in the same manner till the whole of the middle space is perfectly filled up, when he begins another course in the same method, and goes on in this mode, with course after course, till he has raised the whole of the stem, when he begins to take in for the roof, in a very gradual manner, in every succeeding course, until the whole is brought to a ridge or point, according to the manner in which the stack is formed. But for the purpose that the roofs may throw off the water in a more perfect and effectual manner, they should be made so as to have a slight degree of fulness or swell about the middle of them, and not be made flat, as is too frequently the practice with indifferent builders of stacks.

"In stacking, where the grain is bound into sheaves, there is seldom more than one person employed in managing the work of building the stack, except in cases where the dimensions are very considerable, in which case it is found necessary to have a boy to receive the sheaves from the pitcher and hand them to the man who builds the stack. In executing the work, it is of the utmost importance that the centre of the stack be constantly kept in a somewhat raised state above the sides, as the sheaves have thus a sloping direction outwards by which the entrance of moisture is more effectually guarded against and prevented. To accomplish this in the most perfect manner, the workman begins in the middle of the stand or staddle, setting the sheaves together so that they may incline a little against each other, placing the rest in successive rows against them till he comes to the outside, when he carries a course of sheaves quite round, in a more sloping manner than in the preceding courses. The bottom of the stack being formed in this way, it is afterward usual to begin at the outside, and advance with different courses round the whole, placing each course a little within the other, so as to bind them in an exact and careful manner, till the stacker comes to the middle. All the different courses are to be laid on in a similar manner until the whole of the stem is raised and completed, when the last outside row of sheaves is, in most cases, placed a very little more out than the others, in order to form a sort of projection for the eaves, that the water may be thrown off more effectually. But in cases where the stems of the stacks are formed so as to project outward in the manner already noticed, this may be omitted without any bad consequences, as the water will be thrown off easily without touching the waste of the stack. The roof is to be formed by placing the sheaves gradually a little more in and in, in every course, until it comes to a ridge, or point, according to the form of the stack, as has been already observed. But in forming and constructing this part of the stack, great care should constantly be taken to give the ear ends of the sheaves a sufficiently sloping direction upward, in order that they may be the better secured from wetness; and to the outside should be given a rounded form, in the manner that has been already noticed.

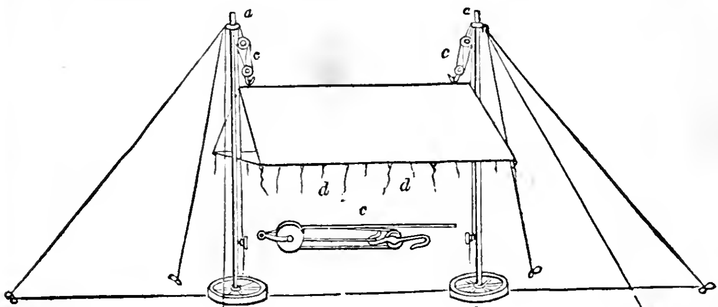
"A funnel or chimney is frequently formed or left in circular stacks, especially in wet districts, in order to prevent their taking on too much heat: where these funnels are not formed with the basement of timber, iron, or masonry, they are produced by tying a sheaf up in a very tight manner, and placing it in the middle, on the foundation of the stack, pulling it up occasionally as the building of the stack proceeds all round it. In setting up ricks in bad harvests, it is a practice in some places, particularly with barley crops, to have three or four pretty large poles tied together, by winding straw ropes round them, set up in the middle, round which the stacks are then built. But except the stacks are large, or the grain, when put into them, is in an imperfect condition, such openings are quite unnecessary.

"The stacking of hay requires much care and attention in the person employed for the purpose, though less than that of building grain stacks. There should constantly be a proper stand or foundation, somewhat raised by wood or other materials, prepared for placing the stacks upon; but nothing of the coping kind is here necessary. In the business of stacking hay, the work should be constantly performed, as much as possible, while the sun is upon the hay, as considerable advantage is thus gained in its quality: and it is necessary to have a stacker that has been accustomed to the business, and a proper number of persons to help upon the stack, in order that it may be well spread out and trodden down.

"The building of hay stacks should be conducted much in the same way as the building of stacks of loose grain; the middle of the stack being always well kept up a little higher than the sides, and the sides and ends well bound in by the proper application of the successive portions of hay as the work advances, and during which it is a good way, where there are plenty of hands, to have the sides and ends properly pulled into form, as by this means much after labour is prevented. It is likewise of advantage that the hay should be well shaken and broken from the lumps during the operation of stacking. The form in which the stacks are built is not of much consequence; but if large, and made in the square form, it is better not to have them too broad, or of too great width, as by this means they are less apt to heat. With the intention of preventing too much heat, sometimes in building hay stacks, as well as those of the grain kind, holes, pipes, and chimneys are left in the middle, that the excessive heat may be discharged; but there is often injury sustained by them, from their attracting too much moisture.

"The hay stacks of Middlesex, England, are more neatly formed and better secured than anywhere else. At every vacant time, while the stack is carrying up, the men are employed in pulling it with their hands into a proper shape; and about a week after it is finished the whole roof is properly thatched, and then secured from receiving any damage from the wind, by means of a straw rope extending along the eaves, up the ends, and near the ridge. The ends of the thatch are afterward cut evenly below the eaves of the stack, just of sufficient length for the rain water to drip quite clear off the hay. When the stack happens to be placed in a situation which may be suspected of being too damp in the winter, a trench of about six or eight inches deep is dug round, and nearly close to it, which serves to convey all the water from the spot, and renders it perfectly dry and secure.

"The stack guard (*Fig*. 3), or cov-



ering of canvass, is employed in some districts to protect the stack while building in a wet season. The worn sails of ships are sometimes made use of for this purpose, though, in most parts, a covering of loose straw or hay is found sufficient in ordinary cases; but where, from a continued rain, the stack is penetrated some way down, a part is removed on recommencing, and dried before being replaced. It is observed by Marshal, that a sail cloth, thrown over and immediately upon the hay of a stack in full heat, is liable to do more injury by increasing the heat, and, at the same time, checking the ascent of the steam, than service in shooting off rain water. The improved method of spreading the cloth he describes as follows: two tall poles (*a*, *a*) are inserted firmly in two cart wheels (*b*, *b*), which are laid flat upon the ground at each end of the stack, and loaded with stones to increase their stability. Another pole of the same kind, and somewhat longer than the stack, is furnished at each end with an iron ring or hoop, large enough to admit the upright poles and to pass freely upon them. Near the head of each of the standards is a pulley (*c*, *c*), over which a rope is passed from the ring or end of the horizontal pole, by which it is easily raised or lowered to suit the given height of the stack. A cloth being now thrown over the horizontal pole, and its lower margins loaded with weights, a complete roof is formed and neatly fitted to the stack, whether it be high or low, wide or narrow; the eaves being always adjusted to the wall plate, or upper part of the stem of the stack; thus effectually shooting off rain water, while the internal moisture, or steam, escapes freely at either end as the wind may happen to blow. This contrivance is readily put up or taken away; the poles being light, are easily moved from stack to stack, or laid up for another season, and the wheels are readily removed or returned to their axles."—(*Loudon.*)

STADDLES. The contents of haycocks spread out in circles of five or six yards to dry.

STAKE AND RICE. A fence made of stakes driven into the ground with branches intertwined.

STAG. Sometimes used for a young horse.

STAGGERS. Apoplexy. See *Horse, Diseases of.*

STALL FEEDING. The feeding of cattle in stalls for the purpose of fattening them more readily than by simple grazing, and at a time when they cannot get fat on pastures, as a regular part of the process of husbandry, is comparatively modern. In former times cattle were slaughtered in October and November, which latter, in most languages derived from the Teutonic, is called *Slaughter month*; there being no possibility of buying fresh meat of any degree of fatness during winter, and salt meat was the food of all classes in that season. But now the process of fattening cattle goes on without interruption during the whole year, and fat beasts come as regularly to market in winter as in summer. Stall feeding is now the principal means by which oxen and cows are rendered fit for the market.

"It has been observed in the article *Soiling*, that one object of that system was to save the waste of food which is occasioned by the treading of cattle in pastures, and by their choosing the sweetest grasses to the neglect of the coarser. The principal object, however, is to save the manure, which in the pastures goes to waste, but in the yards or stall is all preserved. In stall feeding another object is looked to, that of increasing the substance of the animal, especially the fat; and to do this judiciously and with profit requires much experience and attention. It has been proved that animals require a certain portion of meat and drink to keep them alive, and that this quantity, in the same species, is, in general, in proportion to the weight of the animal. If an animal has his exact ration of food, he will continue in health, but he will not increase in weight: in this case, therefore, it only produces a certain portion of manure, which is not equivalent to the food consumed. If a larger quantity be given, the animal, if in health, will increase in weight, and the more food he has, within a certain limit, the faster will be this increase: but there is a point where increase stops; and if by any means the animal is induced to take more, his stomach will be deranged, and he will become diseased, and occasion loss by overfeeding. It is consequently of great importance to the stall feeder to ascertain what is the exact quantity of food which it will be most profitable to give to a stall-fed animal. Experience alone can teach this; but some rules may be given which will enable any one who wishes to stall feed cattle not greatly to err in his mode of feeding, and soon to find out what is the most profitable course to pursue. For this purpose, it is essential that, after having ascertained by experiment the quantity of food which will give the greatest increase of flesh per week on a certain weight of beasts when put up to fatten, all the food given to the cattle be carefully weighed, and no more given in any day than is needful. The quality of the food should also be attended to; for a truss of fine, well-made clover, lucern, or sainfoin hay, may contain double the nourishment of another truss of coarse marsh hay. The best kind of food should always be reserved for fattening cattle. Roots are excellent helps; but roots alone are too watery, and must be corrected by dry food, such as straw cut into chaff, or good hay, and especially farinaceous food, whether it be corn ground or bruised, or oil-cake after the oil has been expressed. By a judicious mixture of food, a much greater increase of flesh may be produced than by an irregular mode of feeding, however good the quality or abundant the quantity given may be. To over feed is as unprofitable as to starve a beast, and produces similar effects. It is of great importance that the cattle should be fed with great punctuality at certain hours during the day, and that the troughs should be cleared of all the remains of food which they do not eat at each time of feeding. Rest and sleep are great aids to digestion, and a little gentle exercise after sleep prepares the stomach for a fresh supply of food: air, also, is highly conducive to health; and hence those beasts which are allowed to move about in a loose stall or a small yard, protected from the rain and wind, thrive better in general than those which are tied up. It is the practice of many good feeders to put oxen in pairs in small stalls, partly open, so that they may be in the air, or under shelter, as they prefer; and the finest oxen, if not the fattest, are prepared for the market in this way. Experience shows that all domestic animals like company, and that they are more contented and quiet when they have a companion than when they are alone. This is the reason why they are put up in pairs. Whatever promotes the health and comfort of the animal will be most profitable to the feeder. When a beast has acquired a certain degree of fatness, it is a nice point to decide whether it would be best to send him to market or continue to feed him. This is often decided by mere caprice or fancy; but if the food has been weighed, and the weekly increase of the beast is noted, which is best done by weighing, but may nearly be guessed by measuring, it becomes a mere question in arithmetic to determine whether his increase pays for his food and attendance; if it does not, there is a loss in keeping him; and if a lean animal put in his stead would increase faster on the same food, every day he is kept there is a loss of the difference between the increase of the two. The pride of producing a wonderful animal at a fair or show may be dearly paid for, and must be put down to the account of luxuries, such as keeping hunters or race-horses.

"The most profitable food for fattening cattle is, in general, the produce of the farm; the expense of all purchased food is increased by the profit of the dealer and the carriage of it; and the only compensation for this additional cost may be in increasing the manure, where the straw and roots of the farm are deficient. In that case, oil-cake, or even corn, may be purchased with advantage; since by means of the manure, crops may be raised which without it must fail. The stalling of cattle, as well as the fattening of pigs, is in many situations the best means of carrying the produce of the farm to market. An ox can be driven many miles, while the food he has consumed would not repay the carriage, and all the manure would be lost, and must be purchased at a great expense, if it can be had at all. If a farmer can feed cattle so as to pay him a fair market price for the food consumed, and something for the risk of accidental loss, he may be well contented to have the manure for his trouble: few stall feeders get more than this in the long run."—(*Rham.*)

STAMENS. The male apparatus of a flower. They are situated immediately within the petals, and consist each of a filament, the anther, and the pollen; of which the two latter are essential, and the former not. They are a modified form of the petal, and are placed next it on the inside, towards the centre of the flower. Independently of their physiological importance, they are much used as good marks of discrimination in systematical botany.

STAMINATE. Having stamens only.

STANDARD TREES. Such trees as are not trained, but grow erect and without support.

STARCH. Amylaceous matter, fecula, composed of carbon 12; hydrogen 10; oxygen 10. "Starch is one of the commonest proximate principles of vegetables. It is characterized by its insipidity, and by insolubility in cold water, in alcohol, and in ether. It dissolves in, or at least forms a gelatinous compound with water, heated to 175°; and this solution, even when much diluted, is rendered blue by iodine. This admirable test of the presence of starch is not effective in hot solutions; and by boiling, the blue colour disappears, but returns in strong solutions as they cool. The term *starch* is commercially applied to that obtained from wheat, which, for this manufacture, is ground and diffused through vats of water, where it undergoes a slight fermentation, and acquires a peculiar sour smell. A part of the gluten and albumen of the grain is thus separated in the form of a viscid scum; the starch being in the form of a finely-divided white powder, is gradually farther separated by washing in large quantities of water, from which it is ultimately allowed to settle, and put into boxes lined with linen to drain; it is then cut into squares, which are dried first in airy chambers upon porous bricks, and afterward rolled up in papers and *stove* dried; it is in this latter operation that the starch acquires that peculiar columnar texture and fracture which is well exhibited on opening a paper parcel as it comes from the stove. A little *smalt* is generally added to the starch, by which it acquires a very pale blue tint, and is better adapted to conceal or cover the yellow tint acquired by worn linen. Starch may be obtained from many other grains, and from potatoes and several other esculent vegetables. *Arrow-root* is the starch of the *Maranta arundinacea*; *sago*, of the *Sagus farinifera*, an East India palm-tree; and *tapioca* and *cassava* of the *Jatropha manihot*. In the process of germination, and by various chemical agents, starch may be converted into a species of gum, dextrin, and sugar."

STAR-WORTS. Composite plants of the genus *Aster*.

STAVES. Staves for spirit puncheons are of white oak, for sugar hogsheads of red oak; but ash and white oak are also used. They are cut of several lengths to make into hogsheads, puncheons, and tierces. The largest size is 72 inches long, 7 wide, and 3 inches thick; for puncheons, tierces, brewer's casks, pipes, &c., staves are 33, 42, 45, 54 inches long, and from $\frac{3}{4}$, $1\frac{1}{4}$, $1\frac{1}{2}$, $2\frac{1}{2}$, to 3 inches thick. The most usual dimensions are 72, 42, and 33 inches, with 3, $1\frac{1}{2}$, and one inch thickness; these measures are exclusive of sapwood. The British duty on staves has been reduced to 28*s.* the 50 cubic feet, and hence they will be largely exported.

STEAMING FOOD. By this means many roots, especially potatoes, are reduced almost to a powder. Corn and other meal, when boiled, is more perfectly digested, and in this way, by answering for imperfect grinding, the steaming of food, or boiling, serves to assist a more perfect assimilation. There is no increase in nutritiousness, and in many cases the economy is very questionable. See *Food*.

STEARIN. The solid part of fats. It is a stearate of glycerine.

STEARIC ACID. The acid obtained by saponizing stearin, and decomposing the soap by a dilute acid. It is a brilliant white, soft body, insoluble in water.

STEATITE. Soapstone.

STEATOMA. A fatty tumour.

STEEPING SEEDS. See *Uredo*, *Manuring Seeds*, *Smut*.

STELLATE. Star-shaped, resembling a star.

STEM. In botany, the upward prolongation of the axis of a plant. It is distinguished from all other parts by bearing buds.

STENELYTRANS. A family of coleopterous insects, many of which have the elytra narrow at the posterior part.

STEPPE. An extensive plain.

STERCORARY. A place where dung and manure is kept.

STEREOMETER. An instrument for taking specific gravities.

STERNUM. The breast bone, to which the ribs are attached.

STETHESCOPE. A wooden tube, twelve inches long, used to assist the ear in determining the character of the sounds of respiration and other functions occurring within the body, to form an opinion of the diseases, &c.

STHENIC DISEASES. Those of increased action or inflammation.

STIGMA. The upper extremity of the style, or female organ of plants: it has almost uniformly a humid surface. It is the part upon which the pollen falls, and where it is stimulated into the production of the pollen tubes, which are indispensable to the act of impregnation.

STILE. In building, an upright piece in framing. In rural affairs, a rough ladder, or set of steps, to allow the passage of men, but not of animals.

STIMULANTS. Substances which produce increased circulation or heat, as alcohol.

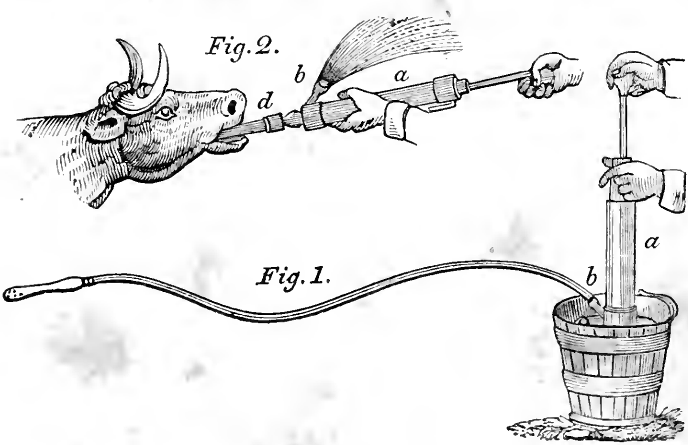
STIPULE. A small leaf or scale situated at the base of the leaf-stalk (*petiole*) of some plants.

STOCK. The live stock, or animals of the farm.

STOLON, STOLE. A running stem which throws off young plants at certain points, as the strawberry. *Stoloniferous* is a derivative.

STOMACH. The cavity or pouch in which food is digested. In most animals there is one stomach only, but in the sheep and ruminants there are four. See *Ox*. In the stomach, properly so called, a fluid termed the *gastric juice* is secreted at meal times, which serves to digest the food.

STOMACH PUMP. An instrument of great value to the farmer to remove poisonous matters or bad food from the paunch of animals. It is also serviceable for administering glysters, and one pump, with a num-



ber of tubes of different sizes, will answer for oxen, horses, or sheep. The instrument consists of a syringe, *a*, having a side opening, *b*, and an ordinary opening at the bottom, *d*. It is used both for throwing fluid into the stomach, &c., and removing it from the body. *Fig.* 1 shows the fixture for injections. The extremity, *d*, is placed into the pail of water, &c., and a long probang screwed on to the side opening, *b*; by pumping, the fluid is driven along the probang or injection tube. When used to remove matters from the stomach, the probang is screwed on to the lower end, *d*, and introduced: the fluid from the stomach passes out at *b* (*Fig.* 2).

Where matters are to be removed from the stomach, tepid water is first injected; the syringe is then unscrewed from the probang at *b*, and screwed on at *d*. It is now a stomach pump, and will draw any thin fluids out of the stomach.

The introduction of the pump is effected by the help of an assistant, who holds the animal by a horn and the dividing cartilage of the nose; the operator now takes the tongue in the left hand, and introduces the tube with the right, the assistant holding the head and neck in a straight line, so as to assist the passage. The jaws are kept open by a regular bit of perforated wood, or by any piece of stick introduced between the teeth.

STOMATA. Minute openings on the under side of most leaves. They are surrounded by small cellules, which have the power of shutting them up.

STONE. A weight of 14 pounds.

STONE CROP. Small, succulent plants of the genus *Sedum*, growing on old walls and roofs.

STOOK and STOOKING. The same as shock and shocking.

STOOL. "The root of a tree or plant, similar to the oak, beech, elm, &c., which throws up shoots. Coppice wood consists chiefly of the shoots sent up by the roots or stools of trees or shrubs which have been cut over by the surface. In general, all dicotyledonous trees are endowed by nature with the property of sending up shoots from the stump or stools; but this is not the case with most of the gymnosperms or coniferous trees. A wood of pines or firs, therefore, when once cut down, can never be renewed except by seeds."

STORK'S BILL. The genera *Erodium* and *Geranium*, which furnish many beautiful flowers; they are propagated chiefly by slips.

STORY POST. An upright post or timber to support a flooring, &c.

STOVE. "In horticulture, a structure in which plants are cultivated that require a considerably higher temperature than the open air. There are two or three kinds of stoves, but the principal are the dry stove and the damp stove. The dry stove is a structure, the atmosphere of which is heated to the temperature of from 55° to 60° during winter, in which are chiefly cultivated succulents, such as the different species of *Ceretus*, *Cereus*, *Staphelia*, *Euphorbia*, *Mesembryanthemum*, and other succulents having similar habits. During winter these plants require very little water, and during summer they require intense heat, and abundance of air and water during fine weather. The damp stove, sometimes also called the bark stove, requires a temperature of between 60° and 70° during winter, with a proportionate increase during summer, accompanied, in both seasons, with a high degree of atmospherical moisture. This moisture is produced partly by evaporation from the bark bed in which the plants are plunged, but chiefly by watering the floor of the house, and by syringing the plants. During summer the plants in the bark stove require all the light which the atmosphere in this country is capable of producing, together with abundance of air, as in the dry stove. Both stoves are heated by smoke flues, or by hot water or steam, circulated in metallic or other tubes. The plants cultivated in the moist stove are exclusively those of the tropics; and those which require the highest degree of heat are chiefly monocotyledonous plants, such as the

Scitamineæ, which include the ginger, plantain, banana, sugar cane, palms, *Orchidaceæ;* and such dicotyledonous plants as the bread fruit, the yam, mangosteen, and other East Indian plants. The bark bed is chiefly employed for producing a uniform degree of moisture and heat to the roots, and also as a reservoir of heat for the atmosphere of the house in case of any diminution from the flues, water or steam pipes, or the sun. Stoves of every description require a constant degree of attention from the gardener throughout the year, more especially such as are devoted to the palms, the banana, the pineapple, and the *Orchidaceæ*."—(*Lindley.*)

STOVER. Refuse hulls, coarse fodder.

STRAINING PIECE. A timber intended to keep two posts or other pieces at a certain distance.

STRAINS, SPRAINS. Injuries produced by over-stretching the ligaments of muscles; they are often very severe, and require cupping and leeching. Occasionally fomentations are sufficient, with rest, and bandaging the part tightly.

STRAMONIUM. Jamestown weed. See *Datura*.

STRANGLES. A disease of young horses. See *Horse, Diseases of*.

STRANGURY, or SUPPRESSION OF URINE, INCONTINENCE OF URINE, BLOODY URINE. "Strangury may arise from an injury done to the kidneys, or to the bladder, by strains, or by the absorption of irritating matters. In these cases, bleed if there be fever; if not, merely give the horse absolute rest; mash him, give gruel, and warm the water given him for drink. *Bloody urine* should be treated in the same way. Some horses have such a natural or acquired weakness of kidneys, as to stale blood with their urine on every occasion of over-exertion. The means frequently used for relief are such as aggravate the complaint, and, indeed, are often the occasion of it, which are diuretics. Strong diuretics injure horses more than strong physic, and benefit them less than any other of the popular means made use of. In retentions of urine, but particularly in the case of bloody urine, they are absolutely improper."

STRATH. A small valley.

STRATUM. A bed of rock, or other deposite.

STRAW. The culm or stalk of the cerealia. It is used both as litter and fodder. For the latter purpose, the different kinds are of unequal value. See *Food*.

STRAW CUTTER. A machine to cut straw into chaff: a chaff engine. The simplest kind is no more than two, three, or more curved knives working between iron bars; but the better sorts consist either of knives set on a fly wheel, or on rollers which press on the straw as it is pushed along the feeding-trough, or hopper. In the best, the straw is pulled forward by the machine, so that the labourer has only to turn the handle and feed the hopper. The number of patents is very great. The machines of Willis, Boynton, Green, Worley, Hovey, Safford, Sandford, and Botts are well known. The cost is from $15 to $50, and they cut from five to thirty bushels per hour. An English machine, by W. Lester, is a very simple and admirable contrivance. Sandford's machine is of a durable construction, and the knives are readily sharpened. Price, $15.

STRAWBERRY. This admirable fruit is yielded by several species of the genus *Fragaria*. The European wood is *F. vesca;* the scarlets are from *F. Virginiana;* the Alpines from *F. collina;* and the *F. Carolinensis, elatior, Chiliensis*, also furnish some of the best kinds.

"The best soil is a strong, rich loam, and one that is tolerably adhesive and retentive of moisture; for, as strawberries are generally injured in this country by excessive drought, it is best to provide against this calamity by planting them in a rather wet soil. A rich soil, however, is not indispensable, as almost any mould that is not too dry will produce a greater or less quantity of fruit.

"Trenching the ground a foot and a half deep, and mixing plenty of well-rotted dung with the soil that is brought to the surface, is the best preparation.

"The time of planting is the first week in August for the offsets of the first spring runners, always choosing those that are large, and rejecting small ones. During the first year, cut off all runners as they appear. Any time from October to May will do for planting out old stools which have borne fruit once. Those which have borne twice are good for nothing, and should be thrown away.

"The offsets may be planted in a single row along the borders of the walks, at ten or fifteen inches apart: if another row be made, it ought to be fifteen inches from the other; they may also be planted in clumps of three or more together, six inches or less apart, and three feet between the clumps. Beds with four rows each, and two feet between the beds for cabbages, answer well. But the best situation for planting strawberries is where a row of dwarf apple, pear, or other trees is grown on either or both sides of a walk, to have a bed of strawberries, four or five feet wide, beneath them; for in this situation they will be afforded that degree of shade which is necessary for them in dry weather, without injuring the trees or being injured by them. In these beds they should first be planted in four rows, two on each side of the trees, and the offsets from these should be allowed to spread so as to extend themselves over the whole of the bed, only cutting off annually those that are disposed to wander from the prescribed bounds of the bed. A strawberry bed of this description would produce a far greater crop than if planted out in single rows, and will continue bearing for a greater number of years, as well as be less liable to injury from drought.

"It is important to fix the roots well in the ground, otherwise they may be drawn out by earth worms, or pushed out of the ground on a thaw succeeding a hard frost.

"The best sorts are Keen's seedling, Hovey's seedling, Myatt's British Queen, Swainstone's seedling, old pine, red wood, the roseberry, and the hautbois. The scarlet is the earliest, and the small red Alpine, which some say is best when raised from seed, others say best from runners, planted in August or September, at six inches distance, will produce fruit from the end of May till the frost sets in. For a late crop, all the flower stems should be cut off as they show, up to the end of June.

"Strawberries are much injured by hot, dry weather, and therefore they must be abundantly supplied with water when this occurs, particularly just as the blossom falls; but the blossom must not be wetted. Weeds must be cleared off, but in stirring the earth with a fork, not with a spade, care must be taken not to go too near the roots, as recommended by some. Birds must be guarded against, as well as snails and slugs, which would eat the blooms and spoil the fruit. Pieces of slate, tiles, tin, boards, or, what is preferable, hay, straw, or dry moss, should be laid three or four inches thick under the fruit as it becomes ripe, to keep it clean from sand: but this precaution is seldom necessary. The superfluous runners and dead leaves should be removed in September. What are termed male or barren plants should always be grubbed up."

STREAK. In mineralogy, the mark left by a mineral when drawn along the surface of paper.

STREET MANURE. The sweepings of streets, consisting of the dung of animals, vegetable garbage, earthy matters, rubbish from buildings, soot, &c. It is necessarily of very different values. It is chiefly useful to lighten stiff soils, and may be used at the rate of 20 to 30 loads the acre.

STRENGTH. "In mechanics, this term is used in the same sense as force or power. Thus, strength of animals is the muscular force or energy which animals are capable of exerting; strength of materials is the resistance which bodies oppose to a force acting upon them. It is obviously a matter of much importance to be able to estimate with tolerable accuracy the efforts which an animal of the average strength employed in labour is capable of exerting, and, accordingly, very numerous observations have been made on the subject; but this species of force is subject to variation from so great a number of circumstances, both physical and mechanical, that the results given by different authors present very little agreement with each other, though they are of great value as affording data for determining the modes in which animal labour is most advantageously employed.

"Of all animals employed as first movers, the horse is, beyond question, the most useful, and that whose labour is susceptible of the most numerous and varied applications. For the purpose of determining his muscular power, the dynamometer may be conveniently used; but as the action of the animal is very quickly reduced by continued exertion, it is more usual to estimate it according to the amount of daily labour performed. Desaguliers and Smeaton estimate the strength of a horse as equivalent to that of five men; the French authors have commonly stated it as equal to seven men; and Schulze makes it equal to that of fourteen men, in drawing horizontally. According to Desaguliers, a horse's power is equal to 44·000 lbs. raised one foot high in one minute. Smeaton makes this number 22 916, Hachett 28·000, and Watt 33 000. The last estimate is commonly understood by the term *horse power* as applied to steam-engines. The quantity of action which a horse can exert diminishes as the duration of the labour is prolonged. The following table, by Tredgold, shows the average maximum velocity with which a horse unloaded can travel, according to the number of hours per day.

Time of March in Hours.	Greatest Velocity per Hour in Miles.	Time of March in Hours.	Greatest Velocity per Hour in Miles.
1	14·7	6	6·0
2	10·4	7	5·5
3	8·5	8	5·2
4	7·3	9	4·9
5	6·6	10	4·6

"The useful effect a horse is capable of producing depends much upon the manner in which his strength is applied.

"*Strength of Materials.*—There are four different ways in which the strength of a solid body may be exerted: first, in resisting a longitudinal tension, or force tending to tear it asunder; secondly, in resisting a force tending to break the body by a transverse strain; thirdly, in resisting compression, or a force tending to crush the body; and, fourthly, in resisting a force tending to rend it asunder by *torsion*. Mr. Hodgkinson gives the following results of his experiments on the resistance of a crushing force on short pillars of some of the most common descriptions of wood, the force being applied in the direction of the fibres:

Description of Wood.	Strength per square Inch, in lbs.	
Alder	6831 to	6960
Ash	8683	9363
Bay	7518	7518
Beech	7733	9363
Birch	3927	6402
Cedar	5674	5863
Red deal	5748	6686
White deal	6781	7292
Elder	7451	9973
Elm		10331
Fir (spruce)	6499	6819
Mahogany	8198	8198
Oak (Quebec)	4231	5982
Oak (English)	6484	10058
Pine (pitch)	6790	6790
Pine (red)	5395	7518
Poplar	3107	5124
Plum (dry)	8241	10493
Teak		12101
Walnut	6063	7227
Willow	2898	6128"

—(*Brande's Dict. of Science; Barlow's Treatise on the Strength of Timber.*)

STREPSIPTERANS. An order of insects possessing rudimentary elytra in the form of scales.

STRIATE. Grooved, coloured with narrow lines or streaks.

STRIGIDÆ. The raptorial birds of the owl kind.

STROBILE. The conical fruit of the pines, firs, hop, &c.

STRONGYLUS. A genus of parasitical intestinal worms.

STRONTIA. An alkaline earth, very similar to lime.

STRUMA. A swelling.

STRYCHNIA. An extremely poisonous vegetable alkali, obtained from the nux vomica and other strychnous plants. It produces violent convulsions.

STUBBLE. The roots and stems of grain plants left in the soil after harvest. If they are long, it will be best to burn them, but on light soils they may be turned in.

STUD. A post or upright in a building: an establishment of horses.

STUMP MACHINE OR EXTRACTOR. A contrivance for the extraction of stumps from new lands. They are usually on the principle of a windlass. The machines of Pratt and Witney have been often recommended. One of these will raise from 100 to 200 stumps a day; they cost from $200 to $400. The Western Farmer and Gardener gives the following method of removing stumps:

"Procure a dry, red-elm lever, about twenty feet long, and about six to eight inches in diameter; a good, stout log chain, with two yokes of oxen; this is all the *machinery* that is necessary. The mode of operation is thus: wrap the log chain round the stump, a little above the ground, and make what is called a log hitch; lay the lever horizontally on the ground, the large end next to the chain and against the stump; make the other end of the chain fast to this end of the lever, drawing the lever tight against the stump; the cattle are hitched to the small end of the lever, and driven round the stump in a circle of which the lever is the radius. One revolution of the oxen round the stump will generally twist out the largest of them; but should not the power thus applied be sufficient to move the stump, the side roots may be uncovered and cut partly off; after this is done, the stump will be easily removed. You will find this plan much preferable to any 'patent stump extractor' that you may have seen puffed in the papers."

STY. See *Hog-sty*.

STYLE. The stem which supports the stigma; it is the upper portion of the carpels.

STYLOBATE. An uninterrupted base common to many columns.

STYPTICS. Substances which, when applied to small wounds, restrain the flow of blood, as alum. The word scarcely differs from astringents.

SUBCLAVIAN. Any part under the clavicle or collar bone.

SUBERIN. The substance of cork. By digesting it with nitric acid, it is converted into suberic acid.

SUBLIMATION. A process by which solids are by the aid of heat converted into vapour, which is again condensed, and often in the crystalline form. This operation is frequently resorted to for the purpose of purifying various chemical products, and separating them from substances which are less volatile.

SUBLINGUAL. The parts lying under the tongue.

SUBSOIL. The earth immediately below that which is tilled. The value of land depends almost as much on the subsoil as the tilth: if it be wet and full of stagnant water, it must be under-drained; if it be hard and rocky, the surface soil dries too readily to a dust; if it be deep and too light, water and fluid manures may drain away wastefully.

SUBSOILING. Loosening the subsoil by a plough without any mouldboard to turn it, has been strenuously recommended of late, as a great improvement in tillage. A heavy plough is first run along the field some six or eight inches deep, and a subsoil plough (see *Plough*) follows in the bottom of the furrow, deepening it to fourteen or sixteen inches in all. This differs from trench ploughing, in which the subsoil is cast up and mixed with the surface, by which the soil is either benefited or injured, according to the nature of the subsoil.

The principal effect of subsoil ploughing is, that the earth is deepened to a considerable depth, and root culture is much improved; the soil is also considerably drained, and, if moor pans exist in it, may be reclaimed from sterility. It is therefore an admirable process in stiff soils imperfectly drained, but in loose gravelly or sandy soils subsoil ploughing is often very injurious. By the tillage of years, the treading of cattle, and the pressure of the sole of the plough and rolling, the surface soil becomes compact, and holds water and manure sufficiently for the crops; but by subsoiling these advantages are thrown away, and a thirsty, loose soil again established.

SUBSTANTIVE COLOURS. Colouring matters which stain the texture or yarn permanently, without the necessity for a mordant; the latter being called adjective colours.

SUBSTITUTION. In chemistry, the doctrine advanced by Dumas, that, in many organic and complex compounds, one element can take the place of another without changing the relations of the others.

SUBSTRATUM. The stratum of a different geological kind immediately below the surface.

SUBULATE. Awl-shaped, round, and tapering to the end.

SUBULICORNS. A family of neuroptera, with awl-shaped antennæ.

SUBULIPALPS. A section of caraboid beetles, some of which have the exterior palpi awl-shaped.

SUCCORY. See *Chicory*.

SUCCULENT. Fleshy, full of water.

SUCKERS. The shoots from the roots of trees or plants near the stem. They are often serviceable for propagation.

SUCTION PUMP. See *Pump*.

SUDORIFICS. Medicines which produce increased perspiration.

SUET. Fat which contains a large proportion of stearin, and is hard. It is best from the loins or kidneys of the sheep, and next from the ox. It is used for the best tallow candles.

SUFFRUTEX. An under shrub, a small shrub, a portion of whose annual stems die away. *Suffruticose* is like an under shrub.

SUGAR. One of the indifferent and ordinary products of plants. It is recognised by its flavour. Chemists distinguish a variety of species of sugar, of which the crystallizable, or *cane sugar*, and uncrystallizable, or *difficultly crystallizable*, or *grape sugar* (*glucose*), are the representatives; these differ in composition, cane sugar being $C_{12}\ H_{11}\ O_{11}$, and grape sugar, $C_{12}\ H_{14}\ O_{14}$; but their chief distinction rests in the circumstance that grape sugar is capable of undergoing fermentation, whereas cane sugar must first be converted into glucose to ferment. Grape sugar is identical with that from fruits, green stalks, and with diabetic and starch sugar. Sugar for commercial purposes is obtained chiefly from the cane, but the beet is also extensively manufactured (see *Beet*), and the maple (see *Maple*) yields a large quantity. Some sugar or molasses is also made from starch of potatoes by boiling it in silver or lead boilers with dilute sulphuric acid: for this purpose, 200 parts of starch, 4 of strong acid, and 800 of water are used, and the boiling continued thirty hours: by steaming at a high pressure, six hours will answer.

SUGAR CANE. *Arundo saccharifera*. It is very readily destroyed by light frosts, and cannot be grown north of 32° N. In Louisiana the frost sometimes destroys the crop, and to save it, the cut stems are piled up, or mattressed on the field in masses three or four feet high. The pressing is done between rollers worked usually by animals, but sometimes by wind, water, or steam power. The process of making the sugar is detailed under the article *Beet*. The following short rules may, however, be of service:

"1. To cut the cane as ripe as possible, but before any acetic acid is formed: litmus paper, touched to the fresh-cut cane, will turn red if acid.

"2. Express the juice without loss of time, as every moment after cutting will deteriorate its quality.

"3. A small quantity of clear lime-water, say one quart to a hundred gallons of juice, should be added the moment it is expressed, unless the juice shows acidity with litmus paper; in that case, no lime should be used, but a solution of sal-soda, or soda ash, should be added until it is precisely neutral.

"4. When the juice is neutral, free from excess of acid or alkali, it should be evaporated in such an apparatus as would finish its charge in thirty minutes: if the boiling power is too small, good crystallization cannot possibly be obtained.

"The whole time occupied, from the cutting of the cane to finishing its boiling, should not exceed one hour.

"5. To know when the boiling is finished, place a thermometer in the kettle, and continue to evaporate until it stands at 239° Fahrenheit. If, when placed to run off after cooling, it should be found too freely boiled, the next time boil to 240°, or, if too light to run off, to 238°, and so on.

"6. The kettle or boiler should be so arranged, that the moment it is done its charge should be thrown into a cooler capable of holding a number of charges. The first charge should be left in the cooler, without stirring, until the second charge is thrown in; then with an oar scrape the crystals found on the side and bottom of the cooler loose, and gently stir the whole mass together: the less stirred the better; so continue at the letting in of each charge, to stir gently: and when all is in the cooler, let the whole stand until it cools down to 175°; then fill out into sugar moulds of a capacity not less than 14 gallons. When cooled in the mould sufficiently, say fourteen hours, pull the plug out of the bottom of the mould, and insert a sharp point, nearly as large as the hole, some six inches; withdraw the point, and stand the mould on a pot to drip.

"7. If the sugar is intended to be brown, leaving it standing on the pot for a sufficient length of time, in a temperature of 80°, will run off its molasses, and leave it in a merchantable shape: it will probably require twenty days. It can then be thrown out of the moulds, and will be fit for use. When moulds cannot be obtained, conical vessels of wood or metal, with a hole at the apex, will answer equally well."

The stools of the cane throw up stems or ratoons for two or three years, unless destroyed by frost, to guard against which they are hilled up in the fall, and opened in part in spring: the same treatment is pursued in regard to the cuttings for propagation. The blue riband cane is that most used in Louisiana. The following from Boussingault gives an account of the cultivation in the West Indies and Central America:

"Three principal varieties of sugar cane are cultivated—the Creole, the Batavian, and the Otaheitan. The Creole cane has the leaf of a deep green, the stem slender, the knots very close together. This species, a native of India, reached the New World after having passed through Sicily, the Canaries, and the West India Islands. The Batavian cane is indigenous in the Island of Java; its foliage is very broad, and has a purple tint: the sap of this variety is much employed in making rum. The Otaheite cane is that which is most extensively grown at the present time. It was introduced into the West India Islands and neighbouring continent by Bougainville, Cook, and Bligh, in their several voyages, and is certainly one of the most important acquisitions which the agriculture of tropical countries owes to the voyages of naturalists. This variety of cane grows with extraordinary vigour: its stem is taller, thicker, and richer in juice than that of the other species. I observed it along the whole coast of Venezuela, of New Grenada, and of Peru; far from having degenerated by its transplantation to the American continent, it appears to have preserved all its original qualities without alteration.

"The sugar cane is propagated by cuttings. Pieces of the stem about 18 or 20 inches long, and having several buds or eyes, are placed two or three together in holes a few inches in depth, and are covered with loose moist earth. From a fortnight to three weeks are required for the shoots to show themselves above ground. The space to be left between each clump of plants depends much on the fertility of the soil; in the most fertile soils the distance may be about a yard, or a little more; and along the rows the spaces may be about eighteen inches. Where land is of no great value it is found more advantageous to give greater space, and so to favour the access of the air and the light. It is not uncommon to see plantations where the canes are spaced at distances of between four and five feet. The time at which the setting of the slips takes place cannot be definitively indicated; it depends entirely upon the epoch at which the periodical rains are anticipated. But in places where irrigation is possible, the setting goes on through all the months of the year The holes for the reception of the slips are usually dug with a hoe, and a negro will make from sixty to eighty holes in the course of a day. When the ground has been previously ploughed, as it is in some of the West India islands, he will make twice as many. Loose, rich soils, when they have a certain moisture, are the best adapted to the sugar cane: it does not thrive in an argillaceous soil, which drains with difficulty. In these moist soils the slips are not laid horizontally and covered, but with one end projecting a little way out of the ground. When the young shoots are covered with narrow and opposed leaves, watering is particularly advantageous, and the plants are repeatedly hoed until they have acquired sufficient vigour to choke noxious weeds. About the ninth month after the plantation of the slips, the shaft of the sugar cane begins to lose its leaves, the most inferior falling first, the others in succession, so that when arrived at maturity it only presents a tuft of terminal leaves. The flowering generally takes place with the conclusion of the year; and the cane is held sufficiently ripe in from two to three months after this epoch, when the stem has acquired a yellow or straw colour. The planters, however, are by no means agreed as to the proper period of the sugar cane harvest; some even insist upon cutting before the flowering, believing that the quantity of sugar diminishes on the appearance of the flower. It is unquestionable, however, that the period that elapses between the planting and the harvest must vary with the nature of the soil, and especially with that of the climate; while in some places the cane may be cut when it is a year old, doubtless there are others where it requires to stand from fifteen to sixteen months. In Venezuela, where the Otaheite cane is grown at the level of the sea, and where the mean temperature of the year is between 81° and 82° Fahrenheit, the cane ripens, according to Colonel Codazzi, in eleven months. In districts at greater elevations under the same parallels of latitude, where the climate is of course not so hot, the cane requires a longer time to come to maturity; where the mean temperature is about 78° Fahrenheit, twelve months are required; where it is about 74° Fahr., fourteen months become necessary; and where it is no more than about 67° Fahrenheit, sixteen months are requisite. The Otaheite cane grows to very different heights: in very favourable circumstances it will reach a height of 16 feet and upward, but its general height may be stated at from 9½ to 10½ feet. Great cane plantations are divided into squares of from 100 to 120 yards on the side, each of which coming to maturity in succession, the labour is easily performed, both in regard to field-work and the manufacture of the sugar.

"The cane is cut close to the root, and before being carried to the mill the terminal tuft of leaves is struck off. These heads in the green state afford excellent food for horses and cattle: when dry they are used for thatching houses. After the first cutting, fresh sprouts arise, which require no other attention than hoeing. In good soils one planting will yield five or six harvests by successive shoots; but I have heard planters affirm that the produce in sugar diminishes from year to year. In Venezuela, cane pieces are replanted every five or six years.

"The cane with its top struck off is carried to the mill, where the juice is expressed, and the stems, which are spoken of under the name of trash, are dried and used as fuel.

"The expressed juice contains crystallizable sugar, an azotized substance analogous to albumen, and some saline matters dissolved in a large quantity of water, which is dissipated by boiling, and the sugar finally won by crystallization. The manufacturing process is conducted with very different degrees of perfection in different places. In some the produce is obtained almost without admixture of molasses, in others the quantity of this article which drains away from the sugar is very large. It is now generally agreed that molasses proceeds in great part from imperfections in the manufacturing processes employed, especially to changes which the sugar undergoes in the course of its concentration by boiling at a high temperature. By the employment of what are called *vacuum pans* of various construction—pans from which the pressure of the atmosphere is removed either by the air-pump, or the condensation of the vapour as fast as it is formed, rapid evaporation is effected at a temperature much below that of boiling water, by which it is found that the relative quantity of sugar to that of molasses is greatly increased. It was long believed, indeed, and that on the authority of the first chemists, that there were two kinds of sugar contained in the sugar cane, one crystallizable, the other uncrystallizable, and constituting the molasses or treacle. The researches of M. Peligot have shown definitively that this conclusion is erroneous; that the cane contains no sugar that is not crystallizable, and that the pre-existence of uncrystallizable sugar or molasses is entirely chimerical. M. Plagne had indeed come to the same conclusion some considerable time ago—as far back as 1826; but his labours were not made known by publication till 1840. M. Casaseca, professor of chemistry at Havana, has very lately confirmed these conclusions, so important for the sugar husbandry of the world. The composition of the juice of the sugar cane is therefore less complex than it was once believed to be; making abstraction of very minute quantities of an albuminous azotized substance, of several salts and a little silica, substances which altogether do not amount to more than two or three hundredths, cane juice may be said to consist of water and of crystallizable sugar in the proportion of from 17 to 20 per cent. The Otaheite cane, analyzed by M. Peligot, actually yielded

Water	72·1
Woody matter	9·9
Soluble matter (sugar) . . .	18·0
	100·0

"This conclusion was verified by M. Dupuy at Guadaloupe in 1841, who, operating on the spot, found the composition to be as follows:

Water	72·0
Woody matter	9·8
Soluble matter (sugar) . . .	17·8
Salts	0·4
	100·0

"The analyses of the Creole cane, made by M. Casaseca at Havana, appear to indicate a larger quantity of woody fibre:

Water	65·9
Wood	16·14
Sugar	17·7
	100·0

"The quantity of sugar yielded by the cane differs considerably. M. Codazzi assigns 6 and 15 per cent. as the extremes, and 7½ per cent. as the mean. M. Dupuy gives 7·1 per cent. as the average. The quantity is, of course, first and most intimately connected with the quantity of juice obtained. But the produce of juice is extremely variable. In Guadaloupe, the juice varies between 56 and 62 per cent. of the cane subjected to pressure. The generality of mills do not, in fact, enable us to obtain more than about 56 per cent. At

New-Orleans the usual quantity obtained is said to be 50, and in Cayenne only 36 per cent. At Havana, according to M. Casaseca, the riband cane yields 45, the crystalline 35, and the Otaheitan 56 per cent. of juice.

"The Otaheite cane was examined by M. Peligot, under a variety of circumstances of age, growth, part of plant, &c. The following table contains the condensed results of his experiments:

	Water.	Soluble matters (sugar).	Woody fibre.
First shoots	73·4	17·2	8·9
Second do. from original sprouts .	71·7	17.8	10·5
Third do. from second do. .	71.6	16·4	12·0
Fourth do. from third do. .	73·0	16·8	10.2
Inferior part of cane	73·7	15·5	10·8
Middle part of do.	72·6	16·5	10·9
Superior part of do.	72·8	15·5	11·7
Knots	70·8	12·0	17·2
Cane of eight months	73·9	18·2	7·9
Cane of ten months	72·3	18·5	9·2

"It would therefore appear, making exception always of the knots which occur in the course of a cane, that the composition of the plant, in its various states and conditions, is almost identical. M. Peligot's important paper, while it informs us of the average composition of the Otaheite cane, satisfies us that the gummy and mucilaginous substances and the uncrystallizable sugar, the existence of which was held as demonstrated, are, in fact, nowise constituents of the sugar cane. Whence we may conclude, with M. Peligot, that every drop of molasses which drains from the sugar is the produce of the manufacture; an opinion to which I assent the more readily from having myself seen, oftener than once, the juice of the cane yield nothing but crystallizable sugar. These analyses farther demonstrate, more powerfully than could any discussion, the imperfection of the processes usually followed in manufacturing sugar. They prove, in fact, that in the mill rather more than a third of the whole juice contained in the cane is left in the trash. This loss might be considerably diminished were more perfect pressure employed in extracting the juice. But it appears that the planters are indisposed to crush the trash too much, as by this it is rendered less fit for fuel, a considerable quantity of which, by the present mode of manufacture, is indispensable. M. Dupree, however, says that by insisting on obtaining from 65 to 66 per cent. of juice in all cases, the trash is still left with all its value as a combustible. The trash, on coming from the mill, appears quite dry. I have seen some which, after having been pressed twice consecutively, looked as if it were impossible, by any farther amount of pressure, to express more liquid. Nevertheless, it was enough to taste this pressed cane, to be satisfied that it still contained a considerable quantity of sugar. To procure this without using more powerful machinery, M. Peligot proposed to steep the trash in water, and to press it a second time. By this means a weak juice is obtained, which, added to the first pressings, raises the produce of sugar from seven to ten per cent. upon the whole amount of cane employed. By following this process, suggested by theory, upon the great scale, M. Dupree has succeeded in obtaining one fifth more than the usual quantity of sugar without making any change in his apparatus, and without finding the trash too much shaken to be burned under his coppers. In some circumstances the increase in the quantity of juice which this procedure implies might be found an objection on account of the larger quantity of fuel required for its evaporation; but wherever a supply of wood is to be had, M. Peligot's method ought undoubtedly to be applied.

"The very dissimilar quantities of

crystallizable sugar obtained from canes, which, as we have seen, all contain very nearly the same quantity of this substance, prove that the processes of concentration and purification of the sap also contribute to the loss which has been indicated. M. Peligot has pointed out several causes which concur to deteriorate sugar: among the number: 1. A viscous fermentation, which renders the sap thick and stringy, like mucilage, by which the boiling becomes difficult and the crystallization of the sugar which has escaped change is rendered imperfect. 2. An acidity, which takes place when the juice is not run at once into the coppers and boiled, an acidity which requires the addition of lime to destroy or to prevent it. The alkaline earth, as I have had occasion to say, is by no means indispensable; its utility, under ordinary circumstances, is probably confined to assisting the defecation by forming an insoluble precipitate with some of the organic substances which are always met with in small quantities in cane juice; perhaps, also, to making an earthy soap with the fatty matters which adhere to the cane and are expressed in the crushing. When lime is added to correct acidity, it forms an acetate or a lactate, salts which are peculiarly soluble, uncrystallizable, and which necessarily retain a quantity of sugar in the sirupy state. 3. The presence of certain mineral salts in the cane. Common salt, for instance, in combining with sugar forms a deliquescent compound, in which one part of salt is united with six parts of sugar; such a compound as this of course renders a large quantity of sirup indisposed to crystallize. It is therefore impossible to be too cautious, according to M. Peligot, in the choice of manure for a cane field; that which contains any common salt must needs be injurious in one way, however advantageous it may be in another. The entire absence of this salt in the soil of plantations which are very remote from the seashore is perhaps one of the causes which increases the quantity of sugar obtained from the crop, and makes it more easily manufactured in such districts.

"M. Codazzi reckons the quantity of white sugar produced by a hectare of land (2·473 acres), planted with the Otaheite cane in the province of Caraccas, at 1875 kilogrammes, or 36 cwt. 3 qrs. 9 lbs. avoir., which is at the rate of 15 cwt. 1 qr. 10 lbs. per acre. Taking 7½ per cent. as the average quantity of sugar obtained, the weight of cane brought to the mill must obviously have amounted to 19,134 kilog., or 18 tons, 15 cwt. 3 qrs. 10 lbs.; or 7 tons, 11 cwt. 3 qrs. 25 lbs. per acre. Assuming the average composition of the plant to be,

Wood (dry)	11·0
Sugar (minimum)	15·5
Water	73·5
	100·0

one acre of land will consequently yield a crop of

	Tons.	Cwts.	Qrs.	Lbs.
Wood (dry)	0	16	2	24
Sugar	1	3	2	6
Water	5	11	2	12
	7	11	3	25

"The trash of the sugar cane undergoes rapid fermentation; it soon exhales a distinct smell of vinegar, and almost the whole of the sugar which is left in it is destroyed."

SUGAR OF LEAD. Acetate of lead, so called from its sweet taste. It is much used in lotions; and in solution with a little vinegar forms Goulard's lotion. It must not be used incautiously, as it is poisonous.

SULCATE. Marked with furrows, or parallel deep lines.

SULPHATES. Salts of sulphuric acid. The principal in agriculture are the sulphate of lime (see *Gypsum*), the sulphate of soda (*Glauber's salt*), and sulphate of potash. The latter is, however, too expensive; it is found in the ashes of some plants. Glauber's salt may be obtained for \$1 to \$1 50 the 100 pounds, and is serviceable as a steep, or as a manure in gardens for the cruciferous plants. The chief value of the sulphates as manures arises from the necessity for sulphur in plants, especially the cruciferous and leguminous families. It would appear that plants possess the property of decomposing the sulphates, for they chiefly require the sulphur, which is an ingredient of fibrin, casein, and albumen, as well as some oils. The sulphate of copper is of great value as a steep, and a solution of sulphate of iron, or green vitriol, is much used in Switzerland to fix the ammonia of putrescent manures.

SULPHITES. Salts of sulphurous acid.

SULPHOCYANATE OF POTASSIUM. A solution of this body is used to detect iron, with which it forms a brownish-red colour.

SULPHOSINAPISIN. A pungent body obtained from mustard, containing both sulphur and nitrogen.

SULPHUR. *Brimstone.* A solid, fusible, insoluble, yellow elementary body; equivalent, 16·1: symbol S: specific gravity, 1·9. It is a non-conductor of electricity, and powerfully electro-positive in its compounds. It is very inflammable, uniting with oxygen, and forming the white, suffocating vapours of sulphurous acid. With three equivalents of oxygen it forms sulphuric acid, or oil of vitriol; a dense, oily acid, of great causticity, and well known in the arts: equivalent, 40·1. Sulphur unites directly with metals at a heat below redness, forming *sulphurets*. The gaseous compound of 1 equivalent of sulphur with 1 of hydrogen, or *sulphuretted* hydrogen, is remarkable for its great fœtor; it is given off by decaying organic matters containing sulphur, and, with the sulphuret of ammonium, constitutes the principal cause of the stench of putrefying animal matters.

Sulphur is abundant in the mineral kingdom about volcanoes. It is present in all vegetables, existing in albumen, casein, and analogous bodies. It has been used to destroy insects, and when made into an ointment with lard and applied to the parts, is often effective. When burned, the pungent, sulphurous acid destroys life, but is also injurious to vegetation. It has the property of bleaching many colours, and especially that of straw. A solution, formed by boiling equal parts of quicklime and sulphur in twenty or thirty times their weight of water, is extremely fœtid and poisonous to insects: it is called the *hydrosulphuret of lime.*

SULPHURETS. Compounds of sulphur with metals.

SULPHURETTED. Containing sulphur chemically united. A solution of sulphuretted hydrogen gas in water is much used as a test for metals in solution.

SULPHURIC ACID, OIL OF VITRIOL. It is procured in commerce by burning sulphur and nitre together in chambers made of lead. The vapours are condensed in water, which is afterward boiled down in platina boilers until the solution becomes of the appearance of oil, and specific gravity 1·8. It should be colourless, but is often brown; is dreadfully caustic, destroying the skin instantly. When water is added, the mixture becomes quite hot, and will often break glass vessels. It combines with all oxides, forming sulphates. Sulphuric acid, mixed with 500 parts of water, has been applied to clover and grass with advantage, but is not better than gypsum, and much more expensive and difficult to manage. It is now used to dissolve bones, but is inferior to muriatic acid. 100 pounds of the best acid dissolve, after much time and with repeated stirrings, about 200 pounds of fine bone dust, converting it in part into a sulphate of lime (gypsum), and into a superphosphate of lime, which is soluble: the solution is enough for an acre, and should be diluted with 200 parts of water, and applied as a top-dressing. The solution must be made in an earthen-ware vessel with great care, lest the acid be spilled.

SULPHURIC ÆTHER. Common æther.

SULPHUROUS ACID. It is composed of sulphur 16·1, oxygen 16. It is a gas readily condensed, soluble in water, and very sour, with the odour of sulphur; in contact with oxygen and moisture, it readily becomes changed into sulphuric acid. See *Sulphur*.

SULPHUR SALTS. A class of salts in which the acid and base both contain sulphur in the place of oxygen, or as their electro-positive element.

SUMACH. (See *Rhus*.) "The powder of the leaves, flower stems, and young branches of the *Rhus coriaria* and *Rhus cotinus*, shrubs which grow in Hungary and the Illyrian Provinces. Both kinds contain tannin, with a little yellow colouring matter, and are a good deal employed for tanning light-coloured leathers: but the first is the best. With mordants, it dyes nearly the same colours as galls. In calico printing, sumach affords, with a mordant of tin, a yellow colour; with acetate of iron, weak or strong, a gray or black; and with sulphate of zinc, a brownish yellow. A decoction of sumach reddens litmus paper strongly; gives white flocks with the proto-muriate of tin; pale yellow flocks with alum; dark blue flocks with red sulphate of iron, with an abundant precipitate. In the south of France, the twigs and leaves of the *Coriaria myrtifolia* are used for dyeing, under the name of *rédoul* or *rodou*."

The common sumach (*R. glabrum*) of the United States is extensively used by dyers and leather dressers; it is more valuable from the South than North, but is inferior to the *R. coriaria*, or Italian sumach of Sicily and the south of Europe. This plant is propagated by layers, as it does not mature fruit.

SUMMER FALLOW. A fallow made during the warm months to kill weeds—a green fallow.

SUNFLOWER. *Helianthus annuus.* A well-known, large composite plant, yielding an abundance of seeds, which are excellent for feeding poultry. It requires a good soil of a clayey basis, but will grow on most tilled lands. It is raised in France for oil, and should be sown broad-cast and thinly, or in rows 18 inches apart. It soon grows sufficiently to cover weeds. An acre will carry 25,000 plants 12 inches apart, and yield 50 bushels of seeds, and upward of 50 gallons of good oil, valuable for the table, lamps, or soap making. The cake is one of the most nutritious fodders known: 1500 pounds will be obtained from the above crop. The leaves are also eaten by cattle, and the young plants removed in thinning form good provender. The stalks are rich in potash, yielding from eight to ten per cent. of it in their ash, but should be returned to the land as manure. It also contains a large proportion of nitrate of potash (nitre). The young plants form as good a crop to plough in as the Jerusalem artichoke, which is indeed of the same genus as the sunflower.

SUPPOSITORY. A solid medicine introduced into the rectum to produce purgation.

SUPPURATION. The common healthy termination of inflammations of the cellular tissues, in which pus is formed. It should be thoroughly evacuated as soon as formed.

SUPRACRETACEOUS. The formations above the chalk, now called tertiary.

SURFEIT. See *Horse, Diseases of.*

SURVEYING. In agriculture, the determination of the contents of any piece of ground or estate; it is usually done in a rough way by a compass with sights, or a plane table and chain of 100 links, or 22 yards. The external boundaries of the field are measured by the chain along straight lines determined by setting up the compass, level, and a staff. The distance between these is ascertained in chains and links; every turn or angle of large size is determined by its bearing with the compass and staff, and a measurement of the length of the straight line, made as often as there are sides or angles. In this way a plan is obtained, giving the angles, bearings, and lengths of the sides bounding the field. This is plotted, and a calculation made of the contents by the ordinary rules of mensuration. For this purpose, the contents are divided into triangles, the side of any of which can be measured on the ground, to assist or correct the reckoning. The chain contains 100 links of 7·92 inches. A square chain forms the tenth of an acre; the calculation is therefore made in links, which are a decimal portion of the acre; and the resulting area being reduced by three figures, gives the number of acres in a field.

But in better examinations the theodolite is used, and the distances determined by trigonometrical observations, and not by measurements with a chain. The inclinations of hills, &c., are also reduced to a plane surface.

SUTURE. The serrated junction of two bones, especially of the skull. In insects, the line along which the wing cases meet. In botany, the natural division or opening in a fruit.

SWAMP. A low lake or morass in which trees grow. The emanations from swamps in the spring and fall are extremely injurious, and fatal to men and animals. They should be drained, if possible. The *mud* from them consists, in a great measure, of vegetable matter, and when composted with lime or putrescent matters, forms a good coarse manure for amending the character of lands. Twenty to forty loads are used to the acre.

SWAN. *Cygnus olor.* The most graceful and majestic of the family of birds. They are much used in Europe to adorn rivers and small lakes, are not destructive to fishes, but feed on vegetables and grains. The female breeds in the summer, lays five to eight eggs, sits a month, and prefers a retired islet. The cygnets are driven off the next spring, and are not in full plumage till three years. These birds are disposed to migrate in the fall, and should have the feathers of one wing clipped. They are also very quarrelsome, and seldom live in peace when more than one pair are placed on a small water. The black and all other kinds of swan are inferior to the large white (*Cygnus olor*), the base of whose upper bill is furnished with a black prominence. They require to be fed in the winter, and the ice broken for their accommodation until the weather is very severe, when they should be allowed to retire to a sheltered yard.

SWARD. The green surface of a meadow.

SWARD GRASSES. A name given to the genus *Poa*, which forms the best natural meadows.

SWATH. The bands of hay or grass cut in mowing.

SWAYS. Long bramble or other flexible rods, used in thatching with coarse straws or reeds.

SWEATING HAY. The slight fermentation which occurs when fresh grass, clover, &c., are placed in heaps. It is attended with considerable heat if the quantity is great, and should, therefore, be looked after. Fruits and grain also undergo a sweating process, if heaped soon after collection. It is the best method to prepare the different kinds of hay. See *Hay-making*.

SWEAL. To singe the hair from hogs or other slaughtered animals with lighted wisps of straw.

SWEET FLAG. *Acorus calamus*, the root of which is pleasantly aromatic.

SWEET GRASS. The genus *Glyceria*, for the most part water grasses. The seeds of *G. fluitans*, or Marona grass, are cultivated in Germany for gruel. The *G. aquatica*, or water fescue, is a large, permanent grass, growing in rich marshes and the edges of rivers, and affording an abundance of good provender.

SWEET POTATO. *Convolvulus battatus.* A convolvulus, the root of which attains a large size, and contains much sugar mixed with an agreeable farina. They require a rich, light soil. The potatoes are set out in a warm place early in April. In the Northern and Eastern States a warm bed is necessary. They sprout in two or three weeks, and throw out a number of runners; these are taken off when three inches above the soil, and transplanted to beds properly prepared in hills four to five feet apart each way. The old tubers continue to throw out runners during April and May. Sometimes they are set out in hills, and not in a bed, and allowed to grow with little interruption: in this way the potatoes are sooner fit for use. The hills must be carefully weeded and worked. They may be taken when large enough for use, but the winter crop should not be removed until the vines are dead. To keep them during winter, they should be dried in the sun till the moisture is driven off, sweated in heaps, and when dry, packed in dry sand in a cellar not subject to wet or frost. There are many varieties of sweet potato, but they are not classified. The kind cultivated in Florida is very large, and altogether superior to those which are known to us. The Nansemond potatoes are also large, and in high repute. The *yams* are of a different genus; the varieties are derived from the *Dioscorea sativa* and *alata*; the roots are often palmated, and often weigh thirty pounds.

SWEET-SCENTED SHRUB. *Calycanthus Floridus.* Allspice, a pleasant, fragrant shrub with dark flowers.

SWINE. See *Hog*.

SWINESTONE. A bituminous limestone, which becomes fœtid when rubbed.

SWING PLOUGH. The plough without a fore wheel under the beam. It is difficult for a novice to manage, from the point sometimes running unequally, and sinking or rising suddenly, and in very rolling land is inferior to the wheel ploughs; but in the hands of an experienced ploughman is often preferred.

SWINGING-TREE, SWINGLE-TREE, WHIPPLE-TREE. The bar of wood or iron to which the traces of each horse are fastened, and which are hitched on to the cart, plough, or other implement to be drawn.

SWITCHING HEDGES. Cutting off the year's shoots. This is done with a sharp hooked blade called a *switching-hook*, or with large hedge shears.

SYCAMORE. The buttonwood.

SYCON, SYCONUS. A fruit consisting of a fleshy disk or hollow receptacle, as in the fig.

SYENITE. A granite with black spots of hornblend. Haddam or Boston granite.

SYMBOL. In chemistry, the abbreviation used to distinguish an element or chemical body. It usually consists of the initial letter, sometimes of the first and second.

SYMPATHY. A veterinary and medical term used to express the existence of certain symptoms in a disease which are remote from the part injured.

SYMPATHETIC NERVE. A grand connexion of nerves from one end of the body to the other, furnished with nervous centres or ganglia, by which some physiologists suppose a uniformity in the operations of the different viscera is maintained. It is also called the trisplanchnic nerve.

SYMPIESOMETER. A kind of barometer.

SYN (from συν, *together*). A common prefix in descriptive words, meaning united.

SYNAPTASE. The white matter of almonds freed from oil, albumen, and other matters. It is probably the same as emulsin.

SYNCARPOUS FRUITS (from συν, and καρπος, *a fruit*). Such as contain several carpels united, as the apple, pear, &c.

SYNCHONDROSIS (from συν, and χονδρος, *a cartilage*). The junction of bones by a cartilage.

SYNCOPE. Fainting; whenever the circulation and respiration become very feeble for a time.

SYNGENESIA (from συν, and γενεσις, *reproduction*). The composite family of plants. A class of Linnæus, in which the anthers are united into a tube, the filaments being usually separate and distinct.

SYNOCHA. Continued inflammatory fevers.

SYNOVIA. The albuminous or serous fluid secreted in the joints, to diminish the friction of the extremities of the bones; it is poured out from little pouches, called synovial bags.

SYNTHESIS. In chemistry, the production of a compound body by a union of its elements or parts.

SYRINGE. A machine consisting of a small cylinder with an air-tight piston or sucker, which is moved up and down in it by means of a handle. The lower end of the cylinder terminates in a small tube, through which a fluid is forced into the body of the cylinder by the atmospheric pressure when the handle is drawn up, and then expelled in a small jet, by pushing the handle in the opposite direction. The syringe acts on the principle of the sucking pump. The syringe is also used as a pneumatic machine for condensing or exhausting the air in a close vessel, but for this purpose it must be furnished with two valves. In the condensing syringe the valves open downward and close upward; in the exhausting syringe they are closed downward and opened upward. The *garden syringe*, so useful for watering plants, and removing caterpillars, red spiders, and other insects, is no more than a large squirt, of a pint or quart size, which discharges fluid from a rose or perforated end instead of a point.

SYRUP. A thick solution of sugar.

SYSTOLE (from συστέλλω, *I contract*). The contraction of the heart, the diastole being its dilatation. These two alternate movements produce the beating.

SYTHE. See *Scythe*.

T.

TACAMAHACA. The *Populus balsamica* of Canada, which yields a resinous, balsamic exudation in the spring, which is sometimes called *Tacambac*.

TAG. A sheep of the first year. *Tags* are the masses of dirt that accumulate on the wool of the tail; the process of removing them is called tagging, and sometimes, when they cause the tail to be fastened to the body, that state is called tagbelt or pinning.

TAGLIA. A combination of pulleys, a tackle.

TAGLIACOTIAN or TALIACOTIAN OPERATION. Any operation in which the skin is nearly cut from one part and made to cover another.

TAIL DRAIN. The main drain, which receives the water of the lesser drains.

TALC. A mineral closely resembling mica, but not elastic.

TALLOW. The melted or rendered fat of the ox or sheep. The greater part of the bodies of sheep and oxen are thrown into immense caldrons, and rendered by steam at a high pressure, in the West and in New Holland. The fat of bones, which amounts to eight or ten per cent., is obtained in the same way, and forms a coarse tallow. Its composition is similar to that of oils, but the stearin is in excess.

TALLOW-TREE. *Croton sebiferum.* A large, lauraceous tree of China, the seeds of which, when pressed, yield a fatty body very similar to tallow. Some specimens of this tree are found growing in the shrubberies of the Southern States.

TALUS. A heap of rubbish accumulated at the foot of a cliff or steep rock.

TAMARIND. *Tamarindus Indica.* A large tree of the leguminous family, native of the tropical East and West Indies. The prepared pods, preserved in sugar, form a refreshing sweetmeat. They contain much citric acid.

TAMARIX. The genus *Tamarix*, small, ornamental shrubs.

TAMPING. In blasting, filling the hole with sand and pieces of rock after a cartridge has been introduced.

TANK. "A reservoir for water or other fluids. The name is sometimes applied to large open receptacles, or ponds, formed by excavating the ground and disposing the removed earth in the form of banks to retain the water; but the tanks which will here be especially treated of, are the smaller covered reservoirs used to collect and retain water and liquid manure for domestic and agricultural purposes.

"The importance of collecting rain water for domestic purposes, especially in districts where springs are deficient or lie at a great depth, has been much overlooked. Waistell urges the importance of placing spouts round all the buildings of a farm to collect the rain water which falls upon them into a tank or tanks, observing that, besides the value of the supply of water thus obtained, the buildings will be benefited by the walls and foundations being kept drier than when the water from the roof is suffered to fall upon them. He states that the quantity of water that falls annually upon every hundred superficial feet, or square of building. is about 1400 imperial gallons. If, therefore, the external surfaces of roofs were adapted to the collection of the rain water which falls upon them, and means were provided for conveying it to covered tanks, in which it might be preserved from evaporation, and kept free from any admixture of impurities, almost every house might be readily and cheaply supplied with a quantity of wholesome water sufficient for the ordinary wants of its inhabitants. The extensive roofs of churches and other public buildings might be employed in like way to collect water for the supply of ponds or tanks for public use. In some cases, even the drainage of lands might also be made available, as the water may be submitted to any required process of filtration before it is allowed to enter the tank.

"Tanks or cisterns to hold water for domestic purposes may be conveniently situated beneath the surface of the ground, so that, being paved over, they occupy no valuable space. They are formed of stone slabs grooved into each other and set in cement; of slate; of large paving tiles bedded in cement; of brick-work; of plates of cast iron; or of thick wooden planks, protected by charring and pitching, or lined with sheet lead. The brick tanks described by Waistell are circular, the sides being built like a well, with bottoms of an inverted dome-shape, of very slight convexity. The top is also dome-shaped, and has an opening in the centre, large enough to receive a man, in order that the tank may be thoroughly cleaned out when necessary. This opening, which may be upon the surface of the ground, or a little above it, should be covered with an oak flap pierced with a number of holes, or with an iron grating. The depth and width of the tank should, it is stated, be nearly equal. If necessary, a smaller brick chamber may be constructed alongside of the tank, in which the water may be filtered through gravel, sand, charcoal, &c., before entering it. It is recommended to make the opening by which water enters the tank near the top. Brick tanks of this description may be rendered water-tight by laying the inner course of bricks in cement, and plastering the whole of the inside with the same to the thickness of about three quarters of an inch. To enable them without injury to bear the great weight of water when nearly full, the earth should be rammed closely round the brick work, and it should be allowed to settle thoroughly before any great quantity of water is admitted. Loudon describes another kind of brick tank, contrived to save expense in construction, by adopting a figure of maximum capacity and minimum surface. When the tank is large, it is proposed to adopt the spherical form; and when of less than five or six feet in diameter, that of a short vertical cylinder, with hemispherical ends. By puddling with clay round about the tank, the necessity for the use of Roman cement is avoided.

"In addition to tanks for water, every farm-yard should have one to collect the liquid portion of the manure, which is washed by the rain through the refuse litter, and also the urine of the stalled cattle. Though not yet generally adopted, in France, Germany, and especially in Belgium, such tanks are considered as necessary to a farm as any of its most common buildings. They are usually constructed of an oblong shape, of brick well cemented, with one or more divisions, and capable of containing at least ten times as many hogsheads as there are heads of cattle on the farm. They are vaulted over, having a small aperture, in which a pump is placed, sufficient to allow a man occasionally to clear out the sediment when the liquid has been pumped up. The best shape to contain a large quantity in the smallest space would be like those before described; but they cannot conveniently be made sufficiently large, and a cubical form, or, rather, that of several cubes in succession, is preferred. A tank for a farm of 200 acres of arable land should be 15 feet wide, 15 deep, and 45 long, giving three cubes of 15 feet, or a cavity capable of containing upward of 10,000 cubic feet of liquid. In this tank the urine is diluted with water to prevent too rapid decomposition, and also to retain the ammonia which is formed; for which purpose gypsum and sulphate of copper are sometimes put into the tanks.

"If the soil be not sandy, clay will answer, instead of mortar, to connect the brick-work, and a plastering of lime or cement will be sufficient to keep out the worms: but in very porous soils the bottom and sides must be puddled, to keep in the liquid; and it may be advantageous to build the walls in cement altogether. The liquid from the yards and stables is carried into the tank by a main drain constructed of brick or stone, and which receives a number of smaller drains from every part of the yards and cattle sheds. Thus the litter in the yard is always dry, and none of the richness of the manure is lost by evaporation.

"Sometimes the tank is vaulted like a cellar under the cow-house and stables, which are washed out twice every day, and all the dung and water are swept into a cess-pool communicating with the tank. Thus a very diluted but rich liquid soon fills the first division of the tank: a sluice is then shut, and the next washings run into a second division, and when that is full, into a third. In the mean time the contents of the first tank have undergone a certain fermentation, by which the caustic ammonia first evolved has become mild and impregnates the water. It is then in a fit state to be carried on the land in tubs or water-carts. When properly diluted, it accelerates vegetation in a surprising degree; but if put on fresh, it burns the grass or any vegetable it touches, because the ammonia is in a caustic state. If a cow drop her urine in a field in a hot summer's day, all the grass it has touched becomes yellow and is burned up; but if the same happen in rainy weather, the spot soon becomes very green, and the grass luxuriant; because, in this case, the urine is amply diluted and its caustic nature corrected. Those who live near gas works may collect the ammoniacal gas water in a tank, and, by the addition of sulphuric acid in very small quantities, they may produce a very fertilizing liquid, which will stimulate vegetation, and be a very good manure.

"The necessary concomitant of a tank, whether for water or manure, is a water-cart, that is, a large cask put upon wheels to bring water from some distance. When there are no means of bringing water in pipes, a water-cart is quite indispensable. It is simply a cask placed on the frame of a cart, with a plug-hole in the end or lower part, from which the water may be let out by a cock, or drop on a flat board or into a bucket with holes, so as to spread it about. The plug-hole is shut by a valve inside, which can be opened by means of a string, the pressure of the liquid keeping it close to the plug-hole.

"Many of the artificial manures, of which a number have been lately proposed, would make excellent liquids by merely mixing them with water in a tank, and allowing a certain degree of fermentation to take place. Thus nothing is lost, and all volatile substances are taken up by the water. The soluble portions are dissolved and the earthy matters diffused, so as to be more equally spread over the land. If it be true that the ammonia found in some plants is chiefly derived from the very small portion discovered in rain water, it follows that a scarcely perceptible impregnation with this salt may have most powerful effects on vegetation.

"When a farm-yard is situated on a hill, and there are fields or pastures on a lower level, at no great distance from it, the liquid from the tank may be conducted by channels lined with clay, having small sluices to direct the streams to any particular field. It may thus be made to irrigate temporarily a considerable surface, which it will greatly enrich. It may be led into the common furrows between the lands, or stitches, in ploughed land, and allowed to soak in them, and then it can be spread with the earth of the furrow, by means of broad shovels, over the growing crops, and will greatly invigorate them. This species of irrigation is common in Lombardy, where much ingenuity is shown in the manner in which water is made to flow in small rivulets between the rows of growing vegetables. The water here is supplied by streams, but the same method would distribute the tank liquor with great effect. A very small quantity of this liquor, allowed to flow into the main feeder of a water meadow, will soon prove how great effects are produced by impregnations which are scarcely perceptible by chemical analysis.

"Small as the experience has hitherto been in this country of the advantages of liquid manure tanks, it has sufficiently proved their use to induce every man who constructs a farm-yard and erects buildings to take in the tank as an essential part of his plan; and even if it only collected the refuse fluids which are allowed to run off in common sewers from most houses, it would soon repay the cost of its construction, while it rendered the ditches in the neighbourhood less subject to noxious emanations from the corrupted matter which now flows into them."

TANNER'S BARK. The bark of oak, &c., used for tanning; when exhausted it is serviceable to the farmer and gardener, and may be used in stoves (see *Stove*), or composted with lime and earth, or putrescent manures, into a good coarse manure. Where the quantity is large and the land in good tilth, it may be burned, and the ashes applied at the rate of ten to fifteen bushels the acre, especially to clovers and grass.

TANNER'S WASTE. The mixture of lime and hair, scrapings and trimmings of skins, as well as the fluid of the lime and steeping vats, are all serviceable in composts; the solids being mixed with earth, charcoal, spent bark, or sawdust, and the fluids being used to moisten the compost heaps.

TANNIN. The astringent principle of galls, sumach, catechu, and numerous barks. It is very soluble in water, and possesses the property of uniting with albuminous matters, and forming *tanno-gelatine*, or leather. When separated from the other substances in bark, it is found to be a white, astringent powder, with acid reaction, and known as *tannic acid;* by the action of moisture and air it absorbs oxygen, and becomes converted into the insoluble gallic acid. The formula of tannic acid is $C_{18} H_5 O_9 + 3\ HO$: it is tribasic, and its salts are called *tannates*.

The value of any specimen of bark for tanning and certain dyes is ascertained by the amount of tannic acid they contain. The amount in the following table is from Davy. In 480 parts,

	lbs.
Oak bark contains	29
Spanish chestnut	21
Leicester willow (large)	33
Elm	13
Common willow (large)	11
Ash	16
Beech	10
Horse-chestnut	9
Sycamore	11
Lombardy poplar	15
Birch	8
Hazel	14
Blackthorn	16
Coppice oak	32
Inner rind of oak bark	72
Oak cut in autumn	21
Larch cut in autumn	8

To this may be added the

Sicilian sumach	78 lbs.
Nut galls	127
Catechu	261

TANNING ON THE PLANTATION. The advantages of having a means of preparing hides on the plantation, in the South and Southwest, need not be enlarged upon; the following simple process is by Mr. Affleck, and from the American Agriculturist:

"Tanning leather for the use of the plantation is an item of good management that should not be overlooked by any planter; nor would it be as much overlooked as it is, if the simplicity of the process was generally known—that process, I mean, that will suffice for making leather for home use. The *tanner* by profession, in order to prepare an article that will command a good price in market, and have a merchantable appearance, puts the hides and skins through a greater number of manipulations; and, that he may work to better advantage, has his arrangements on a more extensive scale.

"The vats, tools, and implements really needed are few and simple. Four *vats* will generally be found all-sufficient: one for a *pool* of fresh water, and for *baiting;* one for *liming;* another for *colouring;* and a fourth for *tanning*. The best size, in the clear, is seven feet long, four and a half feet wide, and five feet deep. They should be placed so as to be easily and conveniently filled with water from a spring, running stream, or cistern. Dig the holes nine feet by six and a half and six; if the foundation is clay, the depth need not be over five feet. Form a stiff bed of *clay mortar* in the bottom, on which to lay the floor, and on it erect the sides and ends of the vat, of plank of almost any kind, sufficiently thick to resist the pressure from without: two inches will be thick enough. When this is done, and the whole nailed fast, fill in the vacant space all round with *well tempered* clay mortar, ramming it effectually; it is on this, and not the planks, that dependance is placed for rendering the vat perfect. When well made, a vat will be good for a long lifetime, the *ooze* preventing the decay of any but the top round of plank. Such a vat will hold fifteen large beef hides (thirty sides), besides a number of small skins.

"The material used for tanning is the bark of the red or black oak, stripped when the sap flows in the spring, stacked and dried, of which about four pounds are supposed to be necessary to produce one pound of leather. There is an article occasionally used, called 'catechu,' which is an extract made from the wood of a mimosa-tree, a native of India, half a pound of which answers the same purpose. Galls, willow bark, the bark of the Spanish chestnut, and common elm, as also sumach, are all used by the tanner. It has been recently found that the root of tho palmetto answers an equally good purpose with the best oak bark.

"Bark has to be ground as wanted; or if the quantity needed is small, and it is not thought advisable to incur the expense of a *bark mill* (from ten to eighteen dollars), it may be pounded in a large mortar, or beat up on a block. It will require one third more of *pounded* than of *ground* bark to afford equally strong *ooze*, which is the infusion of bark.

"The principal tools requisite are a *fleshing-knife*, *currier's knife*, a *brush* like a stiff horse-brush, and a *fleshing-beam*. The fleshing-beam is made by splitting in two a hard-wood stick of about a foot in diameter, inserting two stout legs, some thirty inches long, in one end, on the split side, so that the other end rests on the ground, with the round side up, the elevated end being high enough to reach the workman's waist. A fleshing-knife may be made by bending an old draw knife to suit the *round* of the fleshing-beam.

"The skins of bulls, oxen, cows, and horses, are called *hides;* those of calves, deer, sheep, &c., are known as *skins*.

"*Fresh* and *dried* hides receive the

same treatment, except in the washing process. Those that are salted and dry (and no hide should be dried with less than from two to four quarts of salt being rubbed on the flesh side: dried without salt, it is extremely difficult to soften them) require to be steeped, beaten, and rubbed several times alternately to bring them to a condition sufficiently soft for tanning.

"Green or fresh hides must be soaked in pure water from twelve to twenty-four hours, to extract all the blood, &c., and soften the extraneous fleshy matter, which must then be removed by throwing one hide at a time on the fleshing-beam, *grain* or hair side down, and scraping or shaving it off with the fleshing-knife, which must be somewhat dull, or the skin is apt to be cut. They are then put in the *liming vat*, which is supplied with strong lime-water, by filling the vat a little over half full of water, and adding thereto four bushels of unslaeked (or of air-slaeked) lime, or at the rate of two thirds of a bushel of lime to the barrel of water. This will suffice for fifteen hides; each time that they are removed and a fresh lot of hides put in, add another bushel of lime, which will keep up the strength for a twelvemonth. Before using, stir the lime well up, and while it is thus mixed with the water put in the hides evenly, so that the lime will settle on every part of them. They are to remain here from ten to fifteen days, or for three or four days after the hair will rub off with the finger completely and with ease. While in the liming vat, they must be moved up and down every other morning, to expose them to the air, and to the equal action of the lime. Being now ready for unhairing, cut each hide in two, by slitting them along the centre of the back with a knife, forming them into *sides*. Throw ten or twelve of these sides on the fleshing-beam, and strip the hair off with the knife; and as they are unhaired, throw each one into the vat of fresh water to bait or soak. When the sides and skins in hand have been all unhaired and thoroughly washed, throw them again, and at once, on the fleshing-beam, with the *grain* or hair side up, and *work them over* (rub and press them) with the knife until all the mucus or mucilaginous matter is worked out. This should be repeated two or three times during ten or twelve days, being each time baited anew in fresh water. And this *working over* must only be done when the sides feel soft and smooth to the touch; as they will, at times, from some unexplained cause, feel rough, at which time they must not be *worked over*. While they are thus *baiting*, they must not be neglected, or they will soon spoil. Tanners are in the practice of adding a 1000th part of sulphuric acid (oil of vitriol) to the last *bait*, which has the effect of swelling the pores and distending the fibres, and thus rendering the skins more susceptible to the action of the ooze: forty-eight hours generally suffice for this last *baiting*.

"In the mean time, some good strong *ooze* should be prepared for the first *tanning* process, called *colouring*. Fill a vat a little more than half full of water, and add bark, in the proportion of one bushel and a half of *ground*, or two bushels of *pounded* bark, to the barrel of water, which will bring the vat up to about two thirds full. When the bark has soaked from four to five days, the sides are put in, and allowed to remain fifteen days; during which they must be *once* well and carefully *fleshed* and *worked over*, and must be drawn up and down every morning, for the first week at least, and the bark well *plunged* or stirred up, to have them *colour* evenly.

"After this, the vat being now two thirds full of this same *ooze*, after drawing out the hides, lay a good coating of fresh bark, of say an inch thick, on top of the water, on which it will float; lay on this a side, spread out evenly; and if it has to be lapped over in any part, lay on more bark until it is all well coated, taking care to place those hides at the bottom of the vat now that were at the top last time. On this side lay an inch coating of bark, and on that another side, and so on, with alternate layers of bark, until the vat is full, or the sides all laid away.

"In this, which is called the *first bark*, the sides must lie four weeks; they are then drawn out, and the spent bark taken out with a *skimmer* or *drainer*. The sides are then replaced as before, with alternate layers of fresh bark in the same ooze, which has acquired some additional strength, notwithstanding the amount of tannin and extractive matter, contained in the bark, that has become intimately combined with the animal fibre of the hide. In this *second bark* they remain six weeks undisturbed, when they receive a *third bark* in the same way, in which they are left another six or eight weeks. Three *barks* will suffice to tan deer, hog, calf, and other small skins; four *barks* will make good sole leather, but five are preferable.

"The *tanning* process being completed, *sole* leather is taken out of the vat, rinsed effectually, and dried in the shade, hanging the sides up by two of their corners to joists, where they may remain until wanted. Those sides intended for upper and harness leather (which are those of cows, &c., the largest and thickest bullock hides being used for sole leather), as also deer, hog, and other small skins, being thoroughly rinsed, are spread out on a strong table, with the grain or hair side up, and scoured with a stiff brush, like a very stiff horse-brush, occasionally throwing on pure water, until *all the ooze* is scoured out. Tanners use the edge of a stone, made smooth, to assist in rubbing out the ooze, and all the water that can possibly be rubbed out. They also use what they call *a slicker*, being a dull edge of copper of about six or seven inches long, set in a piece of wood to serve as a handle.

"After they are all served thus, and rubbed as dry as possible, the table is cleaned off, and the skins thrown back upon it, *grain side* up, and are rubbed with tanner's oil (codfish oil) as long as the leather will receive it. Harness leather must be completely saturated. As they are oiled, fold them up and lay them aside. When they are all gone over, lay one on the table at a time, *flesh* side up, and with a rag rub on all the *dubbing* that the leather will absorb. Thin hides require but a small quantity. Harness leather must have a heavy coating.

"*Dubbing*, which consists of equal parts of tar and tallow, melted together, and well mixed, must be made the day previous to being used. Lard *may* be used in place of tallow, but will require a less proportion of it. Each side of leather is then hung up by two corners to joists, there to remain until dry, or until wanted.

"If iron or steel touches a hide during the process of tanning, when in the least wet, or even moist, it will discolour it, forming an indelible black mark.

"To *blacken* harness or other leather, take the skin when completely dried, and if any greasy spots appear, showing that more oil or dubbing has been applied than the leather could absorb, wet the spots with a little strong ooze, and scrub them out with the brush; then apply a good coat of *copperas* (sulphate of iron), dissolved in ooze, until the leather has a good colour all over. After this, when dry, put on another good coat of oil. The leather may then be smoothed off with a rounding edge of polished steel, or glass, or stone."

A discovery has recently been made which seems likely to revolutionize the tanning trade. By means of a tanning machine, or pair of horizontal rollers, fixed over a tan-pit, between which is fixed a band or belt of hides attached by ligatures to each other, to the number of 50 to 100, and by which the rollers are constantly fed or supplied, the hides are lifted out of the pit on one side of the machine. As they pass between the rollers, the exhausted ooze or tanning liquid is pressed out of them, and they are deposited in folds in the pit on the other side of the machine, where they absorb another supply of fresh tannin. The first hide having been inserted between the rollers, the others follow in succession, and upon arriving at the end of the band the motion of the roller is reversed, and the belt is returned through the machine to receive another squeeze. This alternating motion is constantly repeated, the pit being replenished from time to time with fresh solutions of tan till the operation is completed. The effects produced by this simple plan are, 1. The shortening of the time of tanning to one fourth of that generally required. 2. The production of a considerable increase of weight. 3. The leather tanned by this method resists water longer than that tanned by the old process. 4. The new method is cheaper than the old. 5. It is applicable to the existing tan-yards, at a comparatively trifling expense, with a capability of working in rounds or series, and of expending tan or liquor. 6. That it is available for all sorts of leather.

TANSY. The plants of the genus *Tanacetum*: they are composite, herbaceous, and tonic.

TANYSTOMES. A family of diptera, most of which have a projecting proboscis.

TAPETUM. A coat of the eye under the black pigment, and peculiar to quadrupeds.

TAPE WORMS. Flat worms (*Tænia*) of great length, and consisting of a number of pieces, which infest the intestines. They are destroyed by large doses of turpentine.

TAPIOCA. A starchy farina from the root of the *Janipha* (*Jatropa*) *manhiot* (*Fig.*). There are two varieties: one with a bitter, poisonous root; the other with a sweet root. The former is prepared with heat.

TAP ROOT. The main root which descends vertically from trees.

TAR. "A dark-brown, viscid liquor, obtained by charring the wood of the fir-tree. It consists of resin, empyreumatic matters, and acetic acid. When inspissated by boiling, it is converted into pitch. The manufacture is simple; a conical hole, usually in the side of a bank, being made, roots and billets of pine are let into the cavity, and the whole is covered with turf, which is beat firmly down above the wood. The wood being kindled, a slow combustion takes place. A cast-iron pan at the bottom of the cavity receives the fluid, and has a spout which projects through the bank and carries the tar into barrels. As quickly as the barrels are filled they are closed with bungs, when the material is ready for exportation. This manner of preparing tar has been derived from the earliest ages. Tar is a very compound substance; it contains modified resin, and oil of turpentine, acetic acid, charcoal, water, &c. Tar is used in medicine as well as in the arts. It is an excellent topical stimulant, when made into an ointment with lard, in dry skin diseases. These two substances, tar and pitch, are of extensive use in the arts.

"Tar may be found useful as an application for cuts in sheep by clipping, and also to the parts affected by the fly. It is also of great use in some cases for applying as a paint to boarding, &c.; but in this use, a little tallow, or other coarse fat, should be melted with it, as by this means it resists the weather more effectually."

TARE. In the great interest at present taken in sheep husbandry, full information is desirable on this crop; for, although tares have not succeeded well in some imperfect experiments hitherto made, there is no reason why, on poorish soils, they should fail if properly managed.

"They are a most important green crop in the improved systems of agriculture, especially on heavy soils, where they thrive best. When sown in autumn, with a small sprinkling of wheat or rye, they cover the ground in spring, and supply abundance of fodder in summer. A good crop of tares is fully equal in value, if not superior, to one of red clover: it comes off the ground in sufficient time to give the land a hasty summer tillage, which is so useful in destroying weeds, and to allow turnips to be sown in the same season. They smother annual weeds if the crop is plentiful, which should always be secured by an abundant manuring; thus they are a good substitute for a summer fallow in heavy soils, and amply repay the labour and manure bestowed upon them.

"There are many species and varieties of tares; but that which is found the best adapted for agricultural purposes is the common tare (*Vicia sativa, Fig.*), of which there are

two principal varieties, very slightly differing in appearance, one of which is hardy, and will stand the severest winters; the other is more tender, and is therefore only sown in spring; but it has the advantage of vegetating more rapidly, so that spring tares sown in March will be fit to cut within a fortnight or three weeks after those which were sown in autumn. By sowing them at regular intervals from September to May, a succession of green tares in perfection, that is, in bloom, or when the pods are formed, may be cut for several months, from May to October. A prudent farmer arranges his crops so that he shall have artificial green food for his horses and cattle at least six months in the year, by having tares fit to cut between the first and second cut of clover. When there are more tares than is absolutely required for this purpose, and the weather permits, they make excellent hay; or, if the weather is not favourable, they are cut and given to sheep, which are folded on the portion already cut. It is an advantage to have portable racks for this purpose, that the fodder may not be trodden under foot and wasted; or the tares may be placed between hurdles, tied two and two, which form extemporaneous racks. It is prudent to raise sufficient seed for another year; but a crop of seed tares raised for sale is seldom profitable, as they greatly exhaust the soil; and the price varies so much in different seasons, that it becomes too much of a speculation for a farmer. The difficulty in distinguishing the seed of the winter tare from the spring variety is so great, that it should either be raised at home, or only purchased from neighbours or from the most respectable seedsmen. It is a common practice with dealers to mix the seeds of the winter tares, after the time of sowing is past, with spring tares, which are in request at a later period. The inconvenience of this is, that they do not vegetate equally, and consequently the winter tare is not in bloom when the spring tare is fit for the scythe. Foreign tares, which are imported in large quantities, are often the growth of southern climates, and will not stand the winter; or they have been raised from seed sown in spring, so as to be really spring tares. The difference is probably more owing to habit than to any real botanical distinction between them. When spring tares are sown in autumn instead of winter tares, they may occasionally stand the frost, if not very severe; but, in general, they rot on the ground and never recover; whereas, the real hardy winter tares, whose vegetation is slower, seem insensible to the severest frosts.

"In the early part of summer, green rye and tares, mixed, are sold at a great price in large towns, for horses which have worked hard and been highly fed in winter. They act as a gentle laxative, and cool the blood: near London, where every produce is forced with an abundance of manure, tares are often fit to cut early in May, and the land is immediately ploughed and planted with potatoes, or sown with mangel-wurzel or ruta baga, which come off in September or October, in time for wheat sowing. Thus two very profitable crops are raised during the time that the land, according to the old system, would have been fallow; and, at the same time, it is left as clean, by careful hoeing, as the best fallow would have made it.

"There are a great many species of tares or vetches, for the terms are synonymous, many of which have been proposed to be introduced into general cultivation; but none seem, on the whole, to be so well adapted to our climate as the common tare: some have biennial and some perennial roots. The *Vicia biennis* has a strong stem and large leaves, and grows four or five feet high; but it is not so succulent as the common sort. It might, perhaps, by cultivation and early cutting, become a useful early fodder, and it may be worth while to make some experiments with it. There are several species of tares which grow wild in bushes and hedges, but they have never been cultivated in the fields, perhaps from the difficulty in collecting the seeds, which shed as they are ripe. Of these, the *Vicia craca* appears most deserving of attention. It bears its blue flower on stems or spikes longer than the leaves, which are downy. It is very common in France among wheat; and, although a decided weed there, it is not much dreaded by the peasants, as it improves the fodder greatly. It has the appearance of great luxuriance in its growth, where it meets with a proper support. If it were mixed with some plants with a strong stem, such as the Bokhara clover (*Melilotus arborea altissima*), which itself affords much fodder, it might probably be cultivated to great advantage.

"In the south of France there is a white perennial vetch or tare, called *Vicia pisiformis*, which is cultivated for its white seeds, of which soups are made, as with the pea and lentil. It grows in very light soils; and, although indigenous to a southern climate, it is said not to be impatient of frost. It has been called by some the Canadian lentil, or the white tare.

"We shall only notice one more of the wild tares, which is an annual: it is called the yellow tare (*Vicia lutea*). It grows in stony soils and among bushes, is very branching, and rises from one to two feet high. From some experiments made by the Agricultural Society of Versailles several years ago, it would appear that this tare might be cultivated with great advantage, and is even superior to the common sort, because it can be cut two or three times during the summer, and affords a very good pasture in winter, which does not stop its vegetation; it will even bloom in a mild winter. Although short, it is so thick upon the ground, that its first cut is as heavy as that of the common tare, which is seldom worth cutting a second time.

"Tares should be sown on land which is well pulverized. If after wheat, the stubble should be ploughed in with a deep furrow after a powerful scarifier has gone over the land several times to loosen it; five or six cart-loads of good farm-yard dung should be ploughed in. The tares should be drilled or dibbled, and the surface well harrowed. The intervals should be hoed early in spring: this will accelerate the growth, and ensure a complete covering of the ground. As soon as the tares show the flower, they may be cut daily till the pods are fully formed; after this, any which remain uncut should be made into hay or given to sheep; for if the seeds are allowed to swell, the ground will be much exhausted. Another piece should be ready to cut by this time, and thus there may be a succession of tares and broad clover from May to November. Tares may be sown as late as August, on a barley or rye stubble, for sheep feed early in winter, or to be ploughed in to rot in the ground where beans and pease are intended to be sown early in spring: this is perhaps the cheapest mode of manuring the land, the only expense being the seed, for the tillage is necessary at all events. In light soils, tares and buckwheat, sown together immediately after barley or rye harvest, will produce a considerable crop of vegetable matter, which may be ploughed in in November. In favourable seasons, wheat may be sown immediately after, without fearing the effect of two white crops following each other; for the tares and buckwheat coming between, by their shade, and the two ploughings of the ground, one when they are sown, and the second when they are ploughed in, will entirely destroy all weeds, and give to the soil that improvement which will enable it to bear as good a crop of wheat as it would have done had it been sown the year after on a clover lay. Clover, which could not be sown with the barley, from the foul state of the land, may be sown among the wheat in the next spring, when it is hoed for the second time. This is held out as a hint to show how an accidental interruption in a rotation may be remedied without any loss of crop or great deviation. As no rule is without exception, so no rotation can always be strictly adhered to; and those crops which admit of being sown at different times of the year are of the greatest use as substitutes for others which could not be conveniently sown without materially altering the succession of crops. In the common course of cultivation of heavy soils, where occasional fallows are necessary to clean the land, one half of the land which requires fallowing may be sown with tares; and thus the clean unproductive summer fallow will only return at every second rotation. If the tares have been manured, or if they are fed off with sheep folded upon the land, the wheat or other crop which is sown after them will be as good as on a clean fallow, or after a good crop of clover. This alone would make tares a valuable crop; and they may be compared in their effect on heavy lands to turnips on lighter soils.

"The seeds of the tare are occasionally ground into meal and made into bread. It is a very poor food; and when there is more seed than can be profitably disposed of, it may be given to pigs; but poultry, especially pigeons, are very fond of it. When given to horses, the seeds of tares are found very heating; and although they produce a fine glossy coat, they are not to be recommended for this purpose."—(*Rham.*)

TARO. A cultivated *Arum* of the Columbia River.

TARRAGON. *Artemesia dracunculus.* A bitter pot-herb, of the same genus as the tansy.

TARSUS, TARSE. The bones articulated to the tibia, and forming the upper part of the foot.

TARTAR. The sediment of wine casks.

TARTAR, CREAM OF. Supertartrate of potash, obtained by purifying tartar.

TARTAR EMETIC. Tartrate of potash and antimony, a powerful emetic, sedative, and expectorant.

TARTARIC ACID. The acid of grapes or of tartar. See *Acids.*

TAXICORNS. A family of coleopterans, in many of which the antennæ enlarge towards the upper ends.

TAXIS. The replacement of parts by the hand.

TEA. The tea plant has been partially introduced into North Carolina with a view to cultivating that important staple; we therefore present the reader with an abstract of the Chinese plan from Loudon:

"The tea districts of China extend from the 27th to the 31st degree of latitude. According to the missionaries, it thrives in the more northern provinces; and from Kæmpfer it appears to be cultivated in Japan as far north as lat. 45°. It seems, according to Dr. Abel's observation, to succeed best on the sides of mountains, where there can be but little accumulation of vegetable mould. The soils from which he collected the best specimens consisted chiefly of sandstone, schistus, or granite. It grows well in St. Helena and Rio Janeiro, and will grow anywhere in a meager soil and moderate temperature.

"The culture of the tea plant in China has been given by various authors. It is raised from seeds sown where the plants are to remain. Three or more are dropped into a hole four or five inches deep; these come up without farther trouble, and require little culture, except that of removing weeds, till the plants are three years old. The more careful stir the soil, and some manure it; but the latter practice is seldom adopted. The third year the leaves are gathered, at three successive gatherings, in February, April, and June, and so on till the bushes become stinted or tardy in their growth, which generally happens in from six to ten years. They are then *cut in* to encourage the production of fresh shoots.

"The gathering of the leaves is performed with care and selection. The leaves are plucked off one by one: at the first gathering only the unexpanded and tender are taken; at the second, those that are full grown; and at the third, the coarsest. The first forms what is called in Europe imperial tea; but of this and other names by which tea is designated, the Chinese know nothing; and the compounds and names are supposed to be made and given by the merchants at Canton, who, from the great number of varieties brought to them, have an ample opportunity of doing so. These varieties, though numerous, and some of them very different, are yet not more so than the different varieties of the grape; they are now generally considered as belonging to one species, the *Thea Bohea*, now *Camellia Bohea* (*Fig. a*), of bot-

anists. Formerly it was thought that green tea was gathered exclusively from *Camellia viridis*; but that is now doubtful, though it is certain there is what is called the green tea district and the black tea district; and the varieties grown in the one district differ from those grown in the other. Dr. Abel could not satisfy himself as to there being two species or one, but thinks there are two species. He was told by competent persons that either of the two plants will afford the black or green tea of the shops, but that the broad, thin-leaved plant (*C. viridis*) is preferred for making the green tea.

"The tea leaves being gathered, are cured in houses which contain from five to ten or twenty small furnaces, about three feet high, each having at the top a large, flat iron pan. There is also a long, low table covered with mats, on which the leaves are laid, and rolled by workmen, who sit round it: the iron pan being heated to a certain degree by a little fire made in the furnace underneath, a few pounds of the fresh-gathered leaves are put upon the pan: the fresh and juicy leaves crack when they touch the pan, and it is the business of the operator to shift them as quickly as possible with his bare hands, till they become too hot to be easily endured. At this instant he takes off the leaves with a kind of shovel resembling a fan, and pours them on the mats before the rollers, who, taking small quantities at a time, roll them in the palms of their hands in one direction, while others are fanning them, that they may cool the more speedily, and retain their curl the longer. This process is repeated two or three times or oftener, before the tea is put into the stores, in order that all the moisture of the leaves may be thoroughly dissipated, and their curl more completely preserved. On every repetition the pan is less heated, and the operation performed more slowly and cautiously. The tea is then separated into the different kinds, and deposited in the store for domestic use or exportation.

"The different sorts of black and green are not merely from soil, situation, and age of the leaf; but, after winnowing the tea, the leaves are taken up in succession as they fall; those nearest the machine, being the heaviest, form the gunpowder tea; the light dust, the worst, being chiefly used by the lower classes. That which is brought down to Canton undergoes there a second roasting, winnowing, packing, &c., and many hundred women are employed for these purposes.

"For more select sorts of tea, the blossoms of the *Camellia sasanqua* (*Fig. b*) appear to be collected, since they are brought over land to Russia, and sold by Chinese and Armenians in Moscow at a great price. The buds also appear to be gathered in some cases. By far the strongest tea which Dr. Abel tasted in China was that called Yu-tien, used on occasions of ceremony. It scarcely coloured the water, and on examination was found to consist of the half-expanded leaves of the plant.

"As substitutes for tea, used by the Chinese, may be mentioned a species of moss common to the mountains of Shan-tung; an infusion of ferns of different sorts, and Dr. Abel thinks the leaves of the common camellia and oil camellia may be added. Du Halde observes that all the plants called tea by the Chinese are not to be considered as the true tea plant; and Kæmpfer asserts that in Japan a species of Camellia, as well as the *Olea fragrans*, is used to give it a high flavour."

TEAK. *Tectona grandis.* A splendid tree of the elevated lands of India, the wood of which appears to be superior even to oak. It is strong, light, oily, and free from dry rot.

TEAM. "Nothing is of greater importance in the management of a farm than the cattle which perform the necessary work in ploughing and other operations on the soil, in drawing manure to the land, and carrying the produce to market. It is evident that the smaller the expense of the team which does the requisite work in proper time, the greater the profit of the farmer, and every saving in this part of the expense of cultivation is so much added to the clear gain. Wherever the land is only partially cultivated, and a portion of it remains in coarse pasture, which costs little or nothing to the occupier, or where extensive open commons afford cheap food for oxen, these last are naturally employed in farm labour. If four oxen do only the work of two horses, they are maintained at a much smaller expense, and, after working for two or three years, their value is improved for the purpose of fattening for the butcher. The necessary gear is much less expensive, especially where the old yoke is still in use, whether across the neck or the horns. In fact, for a poor man who has only a few acres of land, and who is situated near a waste or common, oxen are by far the most economical team. Many writers on agriculture, who in general have more theoretical than practical knowledge of husbandry, have maintained the general superiority of an ox-team over that composed of horses, and have given calculations which appear clearly to establish that point. But, on the other side, it may be observed, that wherever arable land is the chief object of the farmer's attention, and the tillage of the soil is brought to any degree of perfection, there oxen are never seen at work, but have been invariably superseded by active horses.

"In Switzerland, which is tolerably advanced in its agriculture, oxen are very generally used for the work of the farm; but there the system of stall-feeding is universal, and having a considerable portion of grass land, which can be irrigated by the streams from the mountains, they cut the coarse, long grass produced there for their cows and oxen; and this food is more congenial to their nature than to horses, which do not thrive on coarse watery grass, and require hay and corn nearly all the year round. But where there is less grass land and more artificial grass, such as lucern, sainfoin, and clover, which is the case in all extensive farms, there horses are chiefly used, this food being suited to their constitution. Not to enter farther into the comparative advantage of oxen and horses, we shall turn our attention to the most profitable management of the latter, which now almost universally compose the farmer's team.

"The choice of the horses for a farm is of great importance. It may be very satisfactory to a rich farmer to see fine, large, well-fed horses in his wagon, moving along as if they followed a procession, with bright harness ornamented with shining brass. This is a luxury like that of the rich man's coach-horses, and as such is very natural and innocent. It is the pride of many a wealthy farmer, and we would not curtail his pleasure or despise his taste; but as a matter of profit or loss, the case is very different: a fat horse does little work, no more than a fat coachman. Horses to be in working condition should be muscular and active. The great, heavy cart-horse may, for a moment, be capable of greater exertion at a dead pull, his weight assisting him; but in a long day the thin, active horse will do with ease what would sicken, if not kill, his heavy companion. Horses about fifteen hands high, with short legs and broad chests, such as the Canadian horse, which walk as fast as an ordinary man, are the most economical for farm work. A pair of such horses will draw a load in a cart sixteen miles and return, or plough one acre and a quarter in ten working hours, having a rest of two hours; while the heavy, slow cart-horses could not walk the distance in the time without being overdriven. This is more than the average work; but in the busy time of the year it is a great advantage to have horses which can, with good feeding, work longer and faster without suffering in their health. The carriers on the roads, who live entirely by the work of their horses, know how to choose them and how to feed them to the greatest advantage, and, without overworking them, to make them do as much as is consistent with their health. If hard work is the cause of some diseases in horses, comparative indolence causes many more. Where horses are sluggish, the men soon become so likewise. To see a wagon with four strong horses returning empty, at the rate of two miles in the hour, with two men, or at least a man and a boy, lying lazily in it, is a sure sign that the work on the farm to which they belong is done at the same rate. A single horse-cart, or a light spring wagon with two horses, driven by a man or boy with reins and a whip, and trotting at the rate of five miles an hour, is a perfect contrast to this, and no doubt the owner has his work done much more expeditiously, and consequently at a cheaper rate. The stage-coach proprietors have generally very light, four-wheeled carriages to carry their corn from their chief stations to places where they keep horses, and they often carry as heavy loads as a farmer's wagon does when carrying corn to market; yet the two horses in the light carriage trot with their load, and the three or four heavy horses of the farmer move at the rate of two miles and a half in the hour at most, both going and returning. It is evident that there is a waste of time and power here, which is so much lost. Horses half-bred between a cart mare and a blood horse are reared by some spirited farmers, and if they are more delicate and susceptible of cold than the common cart-horses, they have many advantages: sometimes they inherit so much courage and vigour from their sire, that they become valuable as carriage horses or hunters, and well repay the expense incurred in rearing them; and, at all events, they are superior to any others for the work of the farm, and are in general docile and tractable. The only inconvenience arises from their spirit. When any sudden obstruction arises in ploughing, such as a considerable root of a tree or a large stone, they make violent exertions, and sometimes break the ploughs or other implements. In this respect oxen are more phlegmatic, and stop when the collar presses on them; so that in breaking up rough commons or newly-cleared woods oxen may be preferred. This is almost the only case where spirit and courage are not an advantage.

"With respect to the food of farm-horses, as we observed before, a great saving may be effected by a judicious use of many vegetables and roots which are easily raised on arable land. Various modes of preparing the food have been recommended, such as steeping corn till it sprouts, baking it into bread, or mixing it with boiled roots. All these may have their advantage where economy is the object; but, with the exception of baked bread made of rye, barley, and oats, and slightly leavened, which is perhaps the best food which can be given to slow-wo king horses, there is nothing so congenial to the healthy stomach of a horse as good hay and dry oats, or beans bruised in a mill and mixed with cut chaff. They require no cooking to be fully digested, and the digestive power of the horse will extract all the nourishment which they contain. But there are cheaper fodders than hay and corn, especially in summer, when they can be given fresh and green. Tares, clover, lucern, and sainfoin, cut as they are wanted, will keep a horse in health and working condition with little or no corn, and at a comparatively trifling expense: carrots are peculiarly relished by horses, and are very wholesome; and Swedish turnips, or ruta baga, given raw in moderate quantities, make their skins shine, and thus prove that they tend to keep them in condition. Every prudent farmer takes care to have a sufficient supply of these cheaper substitutes for hay and corn, keeping these last as a reserve and auxiliary to the former. In a prize essay of the Highland and Agricultural Society, on the comparative advantages of raw and boiled grain as food for farm horses, the author adduces some experiments, which lead to the conclusion that there is no advantage in boiling grain, but rather the contrary. The cost of keep of a horse per day on different food has been given as follows:

10 lbs. of straw cut into chaff . . .	1*d.*
10 lbs. of oats, at 3*s.* per bushel . .	9
16 lbs. of turnips, at 10*s.* per ton . .	1
Expense of cutting	1½
	1*s.* 0½*d.*

or,

16 lbs. of hay, at 3*s.* 6*d.* per cwt. .	6*d.*
5 lbs. of oats, at 3*s.* per bushel . .	4½
16 lbs. of turnips, at 10*s.* per ton . .	1
	11½*d.*

or,

28 lbs. of steamed turnips	3½*d.*
7 lbs. of coals, at 1*s.* per bushel . .	1
Expense of steaming	½
16 lbs. of straw, at 1*l.* per ton . . .	1½
	6½*d*

"This last appears the most economical food, but steamed turnips and straw only would probably not keep a horse in good working condition, and it is not said how long the experiment was continued, nor whether the horses thus fed lost weight. The food is also valued at a low rate.

"It is evident that if farm horses can be kept in condition for 6½*d.* a day, which is not 4*s.* a week, while on hay and oats, in the common mode of feeding, they will cost more than double that sum, the saving in a year would amount to nearly £10 on each horse; and as every twenty-five acres of a farm of moderately light land will require one horse for its cultivation, there will be a saving of eight shillings per acre, probably half the rent, and more than half the profit. However this may be, there is no doubt that it is of great importance to ascertain what is, on the whole, the best and cheapest mode of feeding farm horses; and without entering into minute calculations, it will be found that various artificial grasses may be made to succeed each other by successive sowings so regularly that the horses shall be kept for six months of the year entirely on succulent green food, which will enable them to do all the necessary work, and keep them in good health and condition. Thus, with the help of carrots, potatoes, and ruta baga, a great saving of hay and oats may be effected in winter, and these crops will take up much less land for their production than hay and oats, and exhaust the soil less, if we except potatoes, which are more profitably used as human food, or to fatten pigs.

"The example of tradesmen and manufacturers who keep horses, and cut all the hay which they use into chaff, mixing it with oats, may be good for a farmer to follow where hay is scarce and beans a good price, but otherwise it is fully as economical to give the hay in racks, provided no more be given at once than a horse will eat up entirely, and a certain ration be allowed for each horse, which experience has shown to be sufficient. In the cavalry, where great attention is paid to economy, the horses have their rations of hay, oats, and straw, according to the exercise they take, or the fatigue they are exposed to; so likewise it should be with a farmer's team. In the old mode of feeding horses with as much hay as they would eat, and two bushels of oats for each horse per week, during at least nine months in the year, and giving them tares or artificial grasses between spring sowing and harvest, when there was less to be done, the expense of a horse was much greater than most farmers could now afford, and more land was devoted to the keep of the team than was necessary.

"It is of great importance to a person about to manage a farm to know exactly what number of horses will be required for its proper cultivation; and this depends upon many circumstances, which must all be taken into consideration, and which will make a very material difference, often as much as half the rent of the land. He is to consider the situation of the farm buildings, especially the stalls and cattle-yards, where the manure is to be made, with respect to their distance from the fields; the state of the roads and the access to the fields, the distance of a good market-town, and whether the fields lie in a ring-fence or are scattered. A farm of good light loam will require one horse for every twenty-five acres for its cultivation, with an additional one for every two hundred acres; that is, nine horses for two hundred acres. The additional horse should be lighter and more active than the rest, for the farmer to ride on and to drive in a light cart; yet it should be capable of supplying the place of any of the others in case of illness or accident, or when extra work is required, as in harvest or seed time. The larger the farm, or rather the fields, the fewer horses are required in proportion to its size, because much time is lost in turning the plough where the furrow is short; and ploughing is always the principal work of the team. If more than two horses are required to plough the ground, the soil must be very compact and heavy; and if this is not compensated by greater fertility, the expense of the horses will much reduce the profit of the farmer. It is the custom in some farms for each ploughman to have the charge of his own horses; but it is far better to make the feeding and cleaning of horses the business of regular servants, who should sleep in or near the stables, and rise very early, so that the horses may be fed and ready to go to work as soon as the ploughman comes. When a man has been eight or ten hours holding a plough, he is not so capable of cleaning and rubbing the horses as one who has only had light work in the day. The horse keepers can prepare manure, make composts, cut hay and straw into chaff for the horses, mow tares or other green food, or hoe the crops in the season while the horses are at work, and the last thing before they lie down at night should be to give the horses their proper ration of hay, and see that their beds are comfortable and everything in proper order in the stables: good grooming is of as great use to a horse as good feeding, and without it they will never be in perfect working condition. The harness should always be cleaned and oiled, and hung up in a separate place, not, as is too commonly done, hung up behind the horses in the stables. There should be no unnecessary ornaments, but strength and simplicity should be studied. The weight and size of the collars are in many places absurd: they cannot be too light, provided they are of sufficient strength. The work in the field, when the days are long, should be divided so as to give the horses at least two hours' rest, during which they should be fed with oats or corn. When the fields are near the stables, the horses may be brought home, but a portable manger is easily carried into the field, such as is used at the inns on the roads where carriers stop to bait. In winter it may be as well to finish the days' work with only an interval of half an hour. The time in summer should be from five in the morning till ten, and from two till seven if the weather is very warm, resting four hours; or from six till eleven, and from one till six, resting two hours. In winter the time is from seven till three, resting half an hour or an hour between eleven and twelve. With good feeding and grooming this is by no means too hard work when the work requires to be carried on briskly. The heavier and lighter kind of work should be so arranged that when horses have worked hard for a day or two, they may have one or two days of lighter work."

TEATHING Feeding or stacking hay for use on the field: eating turnips, &c., on fields, or young wheat in spring.

TEASEL, or FULLER'S TEASEL. *Dipsacus fullonum.* It is an herbaceous biennial, of the composite family, growing four to six feet high, and cultivated for the rough, prickly flower head, which is used in the manufacture of cloth, flannel, &c. The soil best suited is a clayey loam, not over rich; the seed is sown in April or May, either broad-cast or in drills eighteen inches to two feet apart. Sometimes caraways are sown with them. One to two pecks of seed are sown to the acre. The plants are weeded, thinned, and deeply worked as they grow, to six inches in the row, or one foot each way, in the broad-cast field. They are fit for cutting the second year about July, or as soon as the blossoms begin to fall from the heads, and are now to be cut immediately above the upper leaves (see *Fig.*) with a sharp knife

or hook, and received into a basket; the cutter should have his hands well provided with stout gloves. Three cuttings are made at intervals of eight to ten days, the ripe heads only being taken. They are to be sunned for a day, and then conveyed into dry rooms or sheds; no water should touch them. They are sorted for sale: the finest and firmest are called kings; the second, middlings; and the inferior, unripe, and brittle kinds scrubs. The sorts are put into open bales of sticks for sale. 9000 heads of the first form a pack, and 20,000 of the second. An acre will yield ten to fifteen packs in all. The haulm is burned on the ground. The crop is not exhausting, but sometimes fails.

TECTRICES. The small feathers which cover the quill feathers.

TEDDING HAY. Spreading it out.

TEETH. To learn the age of horses by, see *Horse*.

TEGMENTA. The scales of winter buds.

TEGUMENT, or TEGMEN. In anatomy, the general covering of the body. In entomology the term is applied to the coverings of the wings of the order *Orthoptera*, or straight-winged insects.

TEMPORAL BONES. The temple bones.

TENACITY. Cohesion. The power of resisting a pulling force.

TENACULUM. A simple small hook, used to seize bleeding vessels in operations.

TENDRIL. A clasping stem, as that of the vine.

TENESMUS. A straining and ineffectual effort to relieve the bowels; it is a symptom of irritations and inflammations of the bowels.

TENON. The end of a rail introduced into a mortice.

TENSOR MUSCLES. Those which tighten a part.

TENT. A plug of lint or sponge introduced into wounds to dilate them, or to stop hemorrhages.

TENTACULA, or TENTACLES. Prehensile, thread-like organs in the lower animals, usually arranged around their mouths.

TENUIROSTERS. Incessorial birds, with a slender bill.

TEREBRANTIA. A section of hymenopterous insects, the females of which are furnished with a *terebra*, or borer, with which she bores into the bark of trees, or the bodies of animals, to deposite her eggs. The ichneumons, wheat insect, &c., are of this class. See *Insects*.

TERETE (from *teres, round*). A term applied to round stems, antennæ, &c.

TERGUM. In insects, the upper part of the abdomen or back.

TERMITES. A genus of insects inhabiting tropical Africa and America, and allied to the ants.

TERRACE. A raised bank, for a promenade and ornamental objects.

TERTIARY FORMATION. Strata situated above the chalk and green sand, disposed in basins, and for the most part sedimentary, but containing some hard rocks. It is divided into three portions, the eocine, miocine, and pliocine, which see.

TESSELATED. Marked into squares, or trapezoids; a pavement laid with square stones of different colours.

TEST. In chemistry, anything by which we distinguish the chemical nature of substances from each other; thus, infusion of galls is a test of the presence of iron, which it renders evident by the production of a black colour in water and other liquids containing that metal; in the same way, sulphuretted hydrogen is a test of the presence of lead, and nitrate of baryta, of sulphuric acid. In metallurgy and assaying, the porous crucible which absorbs the liquid vitrifiable oxide of lead and other metals combined with it is sometimes called the *test*.

TESTA. The shell or integument of a seed.

TESTACEANS. Animals provided with a shell.

TESTES. The glands which produce the reproductive secretion of male animals.

TESTUDINATA. A tribe of animals like the tortoise, furnished with a carapace or horny covering.

TETANUS. Locked jaw.

TETHERING. Fastening cattle or horses by a rope, or chain, to a post, or tree, to give them a limited pasturage.

TETRADYNAMIA. Having four long and two short stamens, as the cruciferous plants.

TETRAGONA. The New Zealand spinach. See *Spinach*.

TETRAGYNIA. Having four pistils.

TETRANDRIA. With four stamens.

TETTIGONIANS. The *Cicadians*, or tree locusts.

THALAMUS. In anatomy, the part of the brain from which the optic nerves have part of their origin. In botany, the part on which the ovary is seated. The succulent red centre of a strawberry, the core in the fruit of a raspberry, are the thalami of these plants. Some botanists call it the receptacle of the fruit.

THALLUS. The leaf-like expansion of lichens, sea-weeds, &c. Hence these plants are sometimes called *Thallogens*, or *Thallophytes*.

THATCH. "This is a covering of straw, rushes, or reeds, as a substitute for tiles, or slates, for houses, barns, and principally for sheds for cattle. The increase of agricultural produce on a farm makes the stacking of corn out of doors a matter of necessity as well as convenience. The temporary thatching of these stacks, as well as of hayricks, has made it necessary that some of the regular servants of the farm should be capable of thatching in a neat and substantial manner, that there may be no delay from want of a regular thatcher. We will first describe the mode of thatching hayricks and corn stacks, as the simplest.

"The rick, or stack, having been formed into a proper shape, either with a roof slanting from a ridge, or conical, and ending in a central point, the straw is prepared by moistening it, that it may more easily bend without breaking. It is then forked up in a loose heap, the straws lying in every direction, and somewhat matted. Portions are now drawn out from this heap in handfuls, which lays the straws again in a more parallel order: these are placed in a forked stick, which will hold several of these bundles or handfuls, and are thus carried to the thatcher on the top of the rick, or stack. He seizes a handful, and bending one end into a kind of noose, he inserts this into the hay or straw near the bottom of the roof, at one end if it be a square roof, or at any convenient part if it be a round one. He presses down the straw which he has thus inserted to about half its length, in order to form the eaves, which extend a little beyond the lower part of the roof. When he has thus laid several handfuls side by side, so as to cover about a yard in width, that is, as far as he can conveniently reach without moving his ladder, he begins another row a little above the place where he began, so that the lower end of the straw now inserted may cover the upper part of the first row, as tiles do each other. Thus he proceeds upward till he comes to the upper ridge of the roof, or to the point of the cone in a round stack. In the latter case the covering diminishes to a point, so as to form a triangle. The ladder is now shifted a yard to one side, and the same operation is performed, care being taken that each fresh handful put on shall be interwoven with that which lies beside it, so that no water can possibly pass between them. Thus the work proceeds till the roof is completed, and it only remains to secure the upper ridge in a square stack, or the point of the cone in a round one. In the first case, the highest layer of straw is made to extend beyond the ridge on both sides, and the ends are brought together and stand up like the bristles on a hog. A rope of straw has been prepared, and many small rods, about two feet long, and cut sharp at the point: these are inserted just below the ridge, in a line with it, and about a foot apart; one end of the straw rope is inserted into the stack, and twisted firmly round the projecting end of the first rod; it is then wound once round the next rod, and so on the whole length of the ridge: this is done on both sides. The straws which form the ridge are now cut with shears horizontally, to give it a neat finish, and at each end a kind of ornament is usually made by winding a straw rope round a handful of the projecting straw, forming a kind of knot or bow, according to the taste of the thatcher. Rods with straw ropes twisted round them are inserted near the edge of the slanting side and all along the eaves, which prevent the wind from blowing off the thatch.

"The only difference in the thatch of a round rick is, that it is brought to one point, where it is tied with straw rope wound round it, and formed into a kind of bow; the rods are inserted a little below in a circle, and a straw rope twisted round them, and likewise around the circular eaves. Barley is generally put into square stacks, and wheat in round ones. When the outside is neatly trimmed and cut smooth, so that no birds can lodge in it, wheat may be kept for years, without danger of injury or loss, much better than in a barn, or even in a granary.

"In thatching sheds and buildings which are to last many years, the straw is prepared in the same manner, but the ends of the handfuls, as they are put on a lathed roof, are kept down by means of long rods, which are tied to the laths of the roof by means of strong tar twine. A much thicker coat of straw is put on; and rye straw, which has a solid stem, is preferred as more lasting, and less liable to be filled with water than hollow straw. Instead of straw ropes, split willow is used, and the rods which are inserted are much nearer each other and more carefully secured. As this kind of thatching is a peculiar trade, it requires a regular apprenticeship to be master of it. The thatching of temporary ricks may be done from mere description, and a very little practice will enable any one to protect his stacks sufficiently by a thatched covering."

THECA. A case, usually the urn of mosses, in which their spores are situated.

THECOSTOMES. Those insects which have their suckers surrounded by a sheath or case.

THEODOLITE. A surveying instrument for measuring both vertical and horizontal angles, and necessary in accurate surveys.

THEORY. The expression of a general law based on numerous ascertained facts. An hypothesis is merely a guess, without any basis on fact.

THERAPEUTICS. The science which treats of the action of medicines.

THERMO-ELECTRICITY. The study of the conditions for the production of an electrical current by heat.

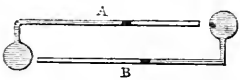
"When one part of a metallic bar is heated and another cooled, an electric current is generated in its substance, which may be rendered evident, and its direction ascertained by the galvanometer. When two metals of different temperatures are brought into contact, similar electric currents are generated, the quantity and direction of the electricity varying with the nature of the metals and their respective temperatures. The best apparatus for exhibiting these thermo-electric currents consists of alternate bars of antimony and bismuth soldered together at their ends, so as to form a compound bar or parallelogram, the junctions of which may be alternately heated and cooled. In this case, the direction of the current is from the antimony to the bismuth; so that these metals bear the same relation to each other in the thermo-electric series as the zinc and silver in the simple voltaic circuit. The term *stereo-electric* has also been applied to these currents, implying their production in solid bodies independent of a fluid, and as opposed to the hydro-electric or voltaic current."—(*Brande.*)

THERMO-ELECTRIC PILE. See above.

THERMOMETER (from θερμος, *warm*, and μετρον, *a measure*). An instrument to measure sensible heat. It most usually consists of a tube of small bore, with a bulb at the lower end containing mercury, which, by its dilatation from heat, ascends within the tube. There is a scale attached, marked into degrees, and the altitude of the mercury is measured by its position opposite the degrees. The marking is after the plan of Fahrenheit, 32° Fahrenheit being the freezing of water, and 212° Fahrenheit its boiling point. The 0 (*zero*) is ascertained by the cold produced from mixing snow and salt so as to melt.

The centigrade scale is used by the French, in which the zero is the freezing of water, and 100° cent. its boiling point.

The thermometer is of great service to the gardener in the hot-house, to regulate its temperature. Rutherford's thermometer marks the lowest and highest degrees of temperature during any given time. "It consists simply of two thermometers: a mercurial thermometer, A, and a spirit thermometer, B, attached horizontally



o the same frame, and each provided with its own scale. The index of A is a bit of steel, which is pushed before the mercury; but, in consequence of its horizontal position, remains in its place when the mercury recedes, and consequently indicates the highest degree of the scale to which the mercury has risen. The index of B is of glass, with a small knob at each end. This lies in the spirit, which freely passes it when the thermometer rises; but when the spirit recedes, the cohesive attraction between the fluid and the glass overcomes the friction arising from the weight of the index, and the index is consequently carried back with the spirit towards the bulb. As there is no force to move it in the opposite direction, it remains at the point nearest the bulb to which it has been brought, and thus indicates the lowest temperature which has occurred. By inclining the instrument, the indices are brought to the surfaces of their respective fluids, and prepared for a new observation."

THERMOSCOPE. A general term, including any implement for measuring heat.

THICKET. A dense accumulation of shrubs or young trees.

THILL. The central beam or draught-tree of a wagon.

THINNING OUT. Removing some plants or branches of a tree to give the rest a better opportunity of growing large. It is an important operation in the orchard, as a tree overburdened with fruit will not produce such fine specimens as one that has a few to perfect.

THISTLE. The genus *Carduus*. The commonest kinds in the United States are the *C. lanceolatus* and *arvensis*: the latter is the well-known Canada thistle. Considered as a weed in our fields, our principal object is to eradicate it, which, in consequence of the ready dispersion of the seeds by the wind, is not easily done, as a slovenly farmer may seed the whole country around.

"Those crops which are usually hoed can readily be cleared of thistles; but where the seed is sown broad-cast, the labour of weeding them out is much greater. If they are not extracted with the root, they will soon grow again with redoubled vigour. In a moist season they may be pulled up by means of a wooden or iron pincers, which grasps them strongly near the crown of the root. When a field has been long infested with thistles, the best way of clearing it is to watch when the thistle is in full bloom and the seed just forming; if it be then cut off at the root, it will die. Thus in two years a field may be entirely cleared of thistles.

"It is chiefly in arable land that thistles are most troublesome. In pastures it is sufficient to eradicate them once, and to permit none to grow along the hedges and ditches. The seed does not readily vegetate, unless it finds a loose soil; and little birds are so fond of it, that they will leave none that is not covered with earth, especially in the beginning of winter."

THORACIC. Relating to the chest. The thoracic duct is a vessel which receives the contents of the lacteals and absorbents, and conveys it to the blood by the subclavian vein.

THORAX. The chest. The cavty of the chest is termed the thoracic cavity, and contains the heart and lungs. In entomology, the second segment of the frame.

THORN. The genus *Cratægus:* thorny shrubs of the family *Rosaceæ.* The *C. oxyacantha* is the May, or English hedge thorn. The *C. crus galli,* or Newcastle thorn, is much used in Delaware as a hedge; it is supposed to be superior to the *C. cordata,* or Virginian thorn.

THORN-APPLE. The stramonium.

THRASHING AND THRASHERS. "The separation of the grain from the ear in corn has always been one of the most laborious operations on a farm.

"Where the grain is thrashed out immediately after harvest, to be put into a granary, the most common practice is to level a portion of a field, and laying the grain in the straw in a large circle, to drive oxen and horses over it till it is all trodden out. Till ingenuity had produced machines to supersede the flail, this was the only instrument in use. The first idea of a machine for thrashing was that of imitating the motion of the flail, but so much depends on the eye of the thrasher, that no mechanism could well imitate the motion of his arms. This was consequently given up, and an imitation of the rubbing of the grains from the ears between the hands, combined with the beaters of a flax-dressing machine, gradually produced the present improved thrashing machine.

"Without a figure it would be difficult to describe the different parts and motions of a thrashing machine. They are, however, now so common, that it will suffice to give the general principal of action, and to mention some of the latest improvements in it. A rapid motion is given to a hollow cylinder round a horizontal axis; on the outer surface there are projecting ribs parallel to the axis at equal distances from each other, or, what is more common, spikes. Around half the cylinder is a case, the inner surface of which is lined with plates of cast-iron grooved in the direction of the axis, or furnished with spikes. The ribs or beaters come quite close to these, so that an ear of wheat or other grain cannot well pass between them without being flattened. The sheaves of grain, having been untied, are spread on a slanting table, and in some machines are drawn in by the spikes. The motion of the cylinder or drum is very rapid. The beaters act on the straw as it comes through, and beat out most of the grain; but what remains is carried in between the beaters and the case, and when it has made half a revolution all the grain has been beaten and rubbed out. It falls on a sieve, which lets the grain through, but retains the straw, which is raked off by hand, or by circular rakes moved by the machinery. The great perfection of a thrashing machine is to rub out every grain and to break the straw as little as possible; the larger the scale of the machine the better it does this. Hand machines have been made on the same principle, but they do not effect any saving in the expense, requiring many men to produce the effect of one horse. Moveable thrashing machines are very generally in use where farms are small. They are often the property of an industrious mechanic, who undertakes to superintend the work, the farmer finding horses and men. Thus he goes from farm to farm. The best machines will thrash 25 to 50 bushels the hour." The thrashers best known are Pitt's, Hall's, Hale's, Whitman's, Stafford's, Warren's, Bostwick's.

THREAVE. Twelve sheaves of grain in the straw.

THROAT. Faux, the commencement of the tube of a personate or labiate flower.

THRIPS. The genus of vine fretters, minute flies which destroy the buds, leaves, and flowers of several fruit-trees. They are extremely acttive, and skip considerable distances. See *Insects.*

THYME. The genus *Thymus,* of

which *T. vulgaris* is cultivated as a well-known aromatic pot-herb of the family *Labiatæ*. It is a perennial, and propagated both by seed and slips: it should be placed in a moderately fertile bed in a dry situation.

THYRSUS, or THYRSE. An inflorescence similar to that of the common lilac.

THYROID GLAND. A gland situated in front of the throat: its office is unknown.

TIBIA. The largest of the two bones of the fore leg. In entomology, the fourth joint of the leg.

TICK. A well-known race of insects found on grass, decayed wood, &c.: they are easily removed by smoking with tobacco. The sheep tick is destroyed by mercurial or sulphur ointment, or dipping the sheep into a strong infusion of tobacco.

TIE. In building, a timber or metal used to bind together two parts which are liable to separate.

TILLAGE. "Applied to arable land, the stirring and preparing the surface of the soil, so as to render it fit for the vegetation of seeds; its object, also, is the destruction of noxious weeds.

"The whole art of cultivation consists in tillage and manuring, and the profit of the husbandman depends on the perfection of the tillage and the economy of labour in producing the effect. A defect in tillage will cause a great deficiency in the crops in ordinary years. To ensure good crops, the soil should be in such a state that the rains and dews may readily be diffused through it, without giving it a wet appearance, or evaporating too rapidly. It requires great knowledge and experience to give any particular soil the exact portion of tillage which is suited to it. A fine garden tilth, as it is called, is the most perfect for light soils which have been long cultivated and manured: when they can be brought to such a state, that after continued rains the surface dries without forming a crust, and crumbles of its own accord, the tillage has been good; and the deeper this soil is stirred, the more it will produce; but where clay abounds in the soil, which in dry weather can be readily pulverized by crushing the dry clods, and be reduced to the finest powder, too much tillage may do more harm than good. The fine clay is soon converted into mud at the surface by the least rain, because it is not sufficiently porous to let the water through it; it dries into a hard crust, which effectually precludes the access of air, and consequently stops the vegetation of the seed. It is only by abundant manuring with organic matter that this natural tendency in clays to cohere can be overcome; and until this is effected, it is best to stir clay soils as deep as possible by means of subsoil ploughs, but they should not be pulverized so that the water cannot run down between the lumps and clods, and especially the surface should be left in such a state of roughness that heavy rains cannot cover it with a coat of mud. The clods which are left on the surface imbibe the moisture more gradually, and, in drying, fall to pieces, by which the young plants are invigorated, and, as it were, moulded up. This is particularly the case in winter after a frost, as all clay land farmers are well aware. It is very easily ascertained whether a soil will bear much tillage or not. It is only necessary to try some of it in a large pot or box; make the surface very fine by breaking the clods, then water it abundantly, and let it dry in the sun; if a crust is formed in drying, that soil will not bear too much harrowing and pulverizing, and should be left in a moderately rough state after sowing or drilling the seed; but if, after it dries, the surface is loose and porous, then the finer the tillage the better the seed will vegetate. The whole depends on the ready admission of air or its exclusion. When grass seeds are sown, the surface should be well pulverized; but this cannot be safely done if the soil is apt to run together when much rain falls soon after the seed is sown. Some plants, like beans, will force their way through a very hard surface;

but small seeds are too weak to do so, and their growth is entirely stopped by the least crust on the surface. Besides the preparatory tillage of the soil before sowing the seed, there is great advantage in the stirring it as the plants are growing. On this depends all the merit of the row culture for every kind of plant, especially those which have esculent roots or extensive foliage, and which are chiefly cultivated for the sustenance of cattle. The effect of deep tillage is here most remarkable. If rows of turnips or cabbages be sown at such a distance that a small plough or other stirring implement can be used between them, and the intervals be stirred more or less, and at different depths, it will be found that the deeper and more frequent the tillage, until the foliage covers the whole interval, or the bulbs swell to a great size, the heavier and more abundant the produce will be. It is worth while to try the experiment: Sow Swedish turnips or mangel wurzel in rows three feet apart: let some of the rows be merely kept clear of weeds by surface hoeing, and the plants be thinned out to the distance of a foot apart: let other intervals be stirred to different depths; some three inches, some six inches, and some nine inches or more. The result will be, that the first rows will appear to have been sown much too far from each other, not half the ground being covered with the foliage of the plants; the others will be covered more and more as the tillage has been deeper, and the last will completely cover the whole intervals. The roots or bulbs will be in exact proportion to the richness of the foliage, and the weight of the deeply-tilled rows will far exceed that of any of the others, while the first will, by comparison, appear a poor and scanty crop, however clear of weeds the surface may have been kept. The soil best suited for this experiment is a good, light loam on a dry or well-drained subsoil; for stagnant moisture under any soil will chill the fibres and check the growth of the plants, however dry the surface may be. It was this which led Tull, the father of drill husbandry, to the conclusion that tillage was all that the soil required to maintain perpetual fertility. He carried his conclusion too far; but we shall not be wide of the truth, if we assert that with proper tillage the soil will be gradually improved, and a much smaller quantity of manure occasionally added to recruit the waste produced by vegetation will render the soil much more fertile than it would be with more manure and less tillage: and as tillage can be increased by mechanical contrivances where labourers are scarce, whereas the supply of manure must generally be limited, it follows that, as a general rule, the land should be well and deeply tilled, due attention being paid to the nature of the soil, and its property of retaining or transmitting moisture. Very loose sands should not be much stirred until they are consolidated by the admixture of marl, clay, peat, or well-rotted dung; but in all cases the manure should be mixed as intimately as possible with the soil, and as deep as the tillage has gone, not including the stirring of the subsoil; for the roots will always penetrate thus far, and find the nourishment which they require. Those plants which throw out roots from the bottom of the stem, as wheat, barley, and oats, require the surface to be most pulverized and enriched to allow these roots to spread; a spring tillage is therefore highly advantageous, which can only be given when the seed has been deposited in rows by drilling, or in patches by dibbling. This last method is found to give much finer crops, from the circumstance that the hoe not only loosens the earth between the rows, but also between the different patches of the growing corn, by which the coronal roots are strengthened, and the tillering of the stems so much encouraged, that it is not uncommon to see twenty, thirty, or more strong stems, all bearing fine ears, arising from one tuft of plants, the produce of one or more seeds, whose roots are matted together and send out fibres in every direction. The crowding of several plants does not prevent their growth, provided the fibres can spread around in a rich, mellow soil, well pulverized, and admitting the air and moisture readily.

"As a perfect tillage requires much labour and minute attention, and in many situations where the farms are large labourers cannot be procured at moderate wages, nor can they always be depended upon to perform the work with sufficient care, mechanical ingenuity has been taxed to invent implements of tillage by which it may be more perfectly accomplished, and at a smaller expense, by using the power of horses instead of that of men, and making implements which will till a considerable breadth at once, and thus save time.

"The old plough, and which, however it may be improved, still acts on the same principle of turning up a fresh portion of the soil, burying that which has for some time been at the surface, will probably always continue to be the chief implement of tillage; but the minuter operations, which are taken from garden culture, require particular contrivances to effect them by instruments. The harrows are but an imperfect substitute for the garden rake, and do not stir the soil to a sufficient depth. Other implements have therefore been invented, which by means of wheels can be regulated so as to act at a greater or less depth. These have received the different names of scarifiers, grubbers, or cultivators, according to the fancy of the inventors. Many of these answer the purpose well, and save labour. They can be used in all directions, so as to pulverize the soil to any degree. Heavy rollers, with and without spikes around them, are used when many clods require breaking; and, although not yet adopted in this country, the Belgian *traineau*, a strong frame of wood, boarded over and loaded with weights if required, is a most effectual instrument in levelling the surface and crushing clods, without pressing them into the soil, as the roller frequently does.

"It would be endless to enumerate all the implements of tillage which are daily invented. As the cultivation of the soil approaches more to that of the garden, more perfect instruments will be used, such as can be directed with great accuracy between parallel rows of growing plants without danger of injuring them. When the width of the stitches or beds accurately corresponds with the width of the instrument, so that the wheels will run in the intervals and the horses step in the same, the soil may be tilled perfectly, although the rows of plants have but a small interval between them; and the largest field will thus present to the eye extended seed-beds or equal rows of growing plants, as we are accustomed to see in a kitchen-garden. The result will be the same as when, for the sake of experiment, we sow the common grains and leguminous plants of the fields in a plot of garden ground; in such case the produce is so far greater, that it quite baffles our calculation when extended to a large surface, and hence the incredible results which we continually meet with in the reports of experiments on some new produce lately introduced: everything is on a magnified scale, owing to superior tillage. No doubt many fields possessed of fertile soils might, by attentive tillage, be made as productive as the best garden ground. The Chinese have, as we are told, already accomplished this by their incredible numbers and indefatigable labour; but science and mechanical contrivance are a substitute for millions of labourers when judiciously applied. The same ingenuity applied to tillage might increase the produce of the earth, if not indefinitely, at least far beyond what we may now suspect.

"In the early ages of agriculture, tillage was almost confined to the ploughing of fallows to clean the land, which was very imperfectly executed, and in ploughing the stubble of one crop to prepare for the seed of another, as long as the land would give a return for the labour. The idea of tillage for the sake of a permanent improvement of the soil was only entertained by a few men who reflected, and that of encouraging the vegetation while the crop was growing was not even thought of. The plough to stir, and the harrows to cover the seed, were the only instruments in use, and they were very rude of their kind."

TILLER. The branching of stems from the root.

TILTH. The fineness and preparation of the soil. See *Tillage*.

TIMOTHY GRASS. *Phleum pratense.* Meadow cat's-tail grass. "This has been highly extolled by many agriculturists for the profusion of hay which it makes, and also for its rapid growth when depastured. It is but a coarse grass when allowed to stand till it is fit for hay; and in rainy weather it too readily imbibes moisture. It is said to give a very sweet and early herbage for sheep in spring, and, mixed with other grasses, is found very useful in laying down land to pasture for a few years.

"The soil which suits timothy grass best is a good, moist, and rather stiff loam. On gravel it soon dies off. It is scarcely to be recommended without a mixture of other grasses, although very heavy crops of it have been grown; and from its strong stem when full grown, it should always be fed off when young, or cut for soiling horses and cattle before the stem has acquired its full growth. In rich land which is tired of clover, it may form a very good substitute, to cut up green and depasture afterward."

The seed is usually sown on wheat in the spring, or it may be sown with oats; two pecks are commonly used, but it is better to use three pecks, or even a bushel when other grasses are not used. Clover and timothy do well together; eight pounds of clover and three pecks of timothy seed may be used.

TINCTURE. A solution in proof alcohol; the substance is usually cut or pounded, and allowed to remain fourteen days, and then strained.

TINE. A tooth or spike of a harrow, &c.

TIN MORDANT. The common mordant is made of 8 parts of aquafortis, 1 part common salt, or sal ammoniac, and 1 part granulated tin.

TISSUE. A membrane, or expansion of a cellular structure in animals or plants.

TITHONICITY. A new imponderable existing in sunlight, and producing chemical changes.

TOAD. *Rana bufo* (*Bufo Americanus*). A well-known batrachian, of great use in the garden to devour insects: it is perfectly harmless.

TOADFLAX. Weeds of the genus *Antirrhinum* and *Linaria*: they are usually perennial, and should be extirpated.

TOBACCO. Plants of the genus *Nicotiana*, cultivated for smoking, and of great service in medicine and gardening; in the latter, for the destruction of insects by smoking, infusion, or snuff. Its activity as a sedative poison arises from the presence of nicotine, an oily base, which is produced during the curing of the leaves.

Varieties.—The principal varieties of tobacco in cultivation are the *N. tabacum* (*Fig.* 1), or Virginian tobac-

Fig. 1.

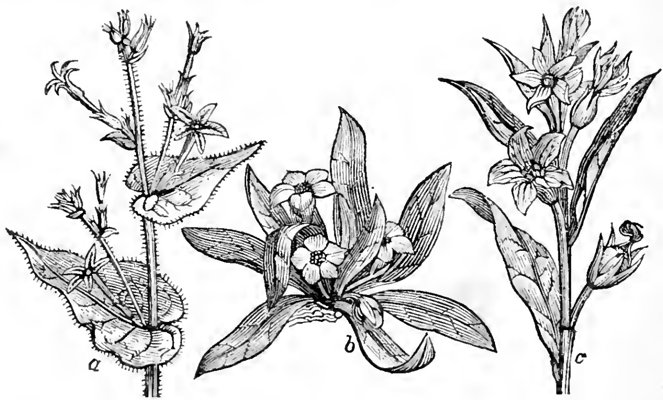
co; the variety with a large leaf (*macrophylla*) is preferred; the *N. rustica* (*Fig.* 2), the green, or Orinoko, as

Fig. 2.

it is sometimes improperly called; the *N. repanda* (*Fig.* 3, *a*), which yields the best Havana; the *N. quadrivalvis* (*b*) and *nana* (*c*) make good tobacco, and are cultivated by the Indians for that purpose.

The natural soil of the tobacco is a forest mould; but it grows well on any light, well-tilled soil which has been impregnated with manure. It requires a dry soil with a good exposure, protected from heavy winds, which break the leaves. The following account of the cultivation is chiefly from Mr. Edmunds:

"*Raising the Plants.*—The land for the *plant-bed* is usually selected in a warm exposure on the south or south-eastern side of a hill in a wood, new ground being always preferred. From this the roots should be grubbed, the rubbish cleared away, and the old leaves raked off. Brush of pine or other wood is then to be piled on until from two to three feet thick all over the bed, and this is to be set on fire. As the beds should be prepared for seeding immediately after the frost is out of the ground, the brush



should be collected and put in place some time during the winter. Instead of burning over the whole bed at once, a part may be fired for an hour or so at a time, proceeding thus over the entire bed. The place is then to be broken up with hoes, and sometimes with coulters drawn by horses or oxen, and the work repeated until the earth is made perfectly fine, being careful to avoid turning under the surface. All the roots should then be extracted, and the land laid off in beds (slightly elevated, if dry, and more if moist or wet) four feet wide; and to 16 square yards a common pipe-bowl of seed is sown. The bed is then trodden or pressed with hoes, and well covered with brush to protect the plants from frosts. When the plants have come fully out, they should be slightly manured with strong manure made fine; this should be repeated frequently, and in larger quantity as the plants increase in size and are able to bear it.

"When the plants have attained a good size, and there is no longer danger of frost, the covering of brush is removed, and the bed weeded with the hand, those employed in this duty taking great care to avoid bruising the tender plants. The beds require frequent picking to keep down the weeds.

"*Preparation and Planting.*—The plants will be generally ready for removal about the last of May or first of June. They are to be drawn out after a rain and transplanted in good ground previously well prepared for their reception.

"*Field Culture.*—The land for tobacco should be of the best quality, either newly cleared and virgin soil, or old ground highly manured and well pulverized, or good clover fallow, ploughed in the fall, manured and cross-ploughed in the spring, just before planting, well harrowed, and then laid off with a plough in rows three, three and a half, or four feet apart each way. Every square thus made is to be scraped with the hoe so as to form a hill, in which one plant is to be set. In case the plants die from drought, or are destroyed by worms, a very common occurrence, others must be set in their places.

"*Cultivation.*—The culture is very much like that usually adopted for Indian corn, the plough, cultivator, and hand hoe being freely used to keep down weeds and loosen the earth.

"It is important to the early growth of the plant to plough and work deep once or twice, so that when it is ripening, the ground will be broken deep and fine. (The coulter is preferred for this operation.) This should be effected without much interference with the roots, as that would check the growth, and prevent the plant from attaining its proper size. And hence the advantage of greater distance between the rows than the common distance of three and a half feet, because the wide rows can be ploughed, and worked with less damage to the roots. In this, as in all other crops, if we wish a good return, "we must speed the plough" and hoe before the roots run out. On our high lands, we should endeavour, by deep and horizontal ploughing, to counteract the bad effects of drought. On our flats, we should aim to prevent the collection of water by drains discharged at the lowest point.

"The bed is best for high land, because it retains more moisture where it is generally needed. The hill, retaining less moisture, is best for flat land, where there is commonly a superabundance.

"*Priming, Topping, Suckering, and Worming.* — As the tobacco plant grows and develops, a blossom bud puts out from the top, which is termed *buttoning*. This top must be pulled off along with such of the upper leaves as are too small to be of any value. The plants are thus left usually about two or three feet high. The plants also shoot out suckers from every leaf, which must be broken off, care being taken not to break the leaf from the main stem. This causes the leaves to spread.

"The most regular topping is performed by measure. The topper carries in his hand a measure six inches long, by occasionally applying which, he can regulate the priming with great accuracy; and as the remaining leaves are numbered, this governs the operation, and gains the object of even topping. The topper should always carry this measure in his hand, as it serves to prevent excuses for negligence and uneven topping. Prime six inches, and top to eight leaves. We have found, by experience, that this is the best average height. We sometimes, but seldom, vary from this general rule. If the land is poorer than common, or if, from the backwardness of the plant, and the advanced state of the season, we apprehend frost, we do not prime as high (say four inches.) If we have an uncommonly rich spot, and there is danger that the top leaves will come to the ground, we should rise in the same proportion. The crop should be wormed and suckered at least once a week.

"*Cutting and Housing.*—In about three months after setting out, the plants assume a spotted and yellowish appearance, indicating that they have attained sufficient maturity for cutting and housing. This stage of the tobacco culture is generally reckoned the most difficult and delicate part of the whole business, and the planter, if he wishes to be successful, must give it all his attention, as the profit of a whole plantation for the year greatly depends upon the diligence and skilful management exercised during the few days of cutting. He should, therefore, be well prepared for this state of the crop, by having the barns close, carts and wagons in good order, and everything arranged to despatch business as much as possible, since it is hard work he has to encounter. To save a heavy crop in the best manner requires both energy and activity. The most judicious hands should be selected for cutters. The plants are cut with a knife near the ground, and suffered to lie in the sun for a few hours, to cause them to 'fall' or wilt. When the field is a pretty large one, a middling or average hand should count the whole number of plants he cuts, so that, allowing each cutter the same number, we may arrive at nearly the whole quantity cut. We should never cut more nor less than will fill the contemplated barn; otherwise there is labour lost in attending to a barn not full, or the overplus is injured for want of firing. The tobacco, after it has 'fallen,' or becomes sufficiently limber, is carried to the barn in carts or wagons, being from six to ten plants on a stick, and stowed away for firing. It is also of great importance to be particular in the arrangement of the sticks. The equal and general circulation of heat throughout the house depends on the manner in which this is done. Our barns commonly have three firing tiers above, and three below the joists. We commence arranging the sticks on the most elevated tier in the roof, to which we give five inches distance; and on each tier, as we descend, we gain one inch; so that on the lowest tier, nearest the fire, the sticks are placed eleven inches apart. This disposition of the sticks, I have ascertained by late experiment, is important. The sticks of tobacco being wider apart next to the fires, gives a freer circulation, and, consequently, a more equal temperature than the usual way of equal distance from bottom to top. The heat having more space to ascend, must be more equal and generally diffused, and will give a more uniform house of tobacco. I esteem this a considerable improvement; and if we have house room, and make a greater difference in the proportionate distance between the sticks, it will be a still better arrangement. The stems of the tobacco are often split to hasten the drying.

"*Curing.*—We commence our warming or preparing fires the day after housing. We prefer what is commonly called the 'bed logs' of green, and the 'feeding' of dry or seasoned wood. By this arrangement the fires are rendered more governable. The bed logs should be nicely fitted to the barn floor, two lengths to reach across, the large ends placed outward, to guard against the tendency of heat to the centre. We keep up our warming fires from 36 to 48 hours, the mercury ranging from 100° to 115°. This will generally bring the leaf to the drying state; the tail, or end of the leaf, now begins to curl handsomely, *and then the planter must be on the alert.* If he is careless, and his fires are made too hot, the aromatic oil passes off with the sap and smoke, and he has a house of red or dark inferior tobacco. If his fires are kept too low, his tobacco gets into a clammy sweat, and the oil escapes. There is much more danger of the former than of the latter evil.

There is more tobacco injured by too much heat than by the want of a sufficiency. The fires should now be kept steady and regular, with a gradual increase of heat, so that in 48 hours the mercury will stand 150° to 160°. It must be kept at or about that temperature until the tobacco is cured.

"*Stripping, Pressing, &c.*—After the plants become sufficiently dried, known by the stems getting hard, which will be in about two months after housing, the leaves are stripped from the stalks. For this operation, a moist time in the spring or late in winter is chosen, to prevent the leaves from crumbling. They are divided by select hands into three classes for stripping: 1st, that which is of the best colour and quality; 2dly, that which is somewhat inferior, comprising the balance of the leaf; 3dly, lugs, or ground leaves. Some planters make still more classes, but this requires more attention and discrimination than can be generally bestowed, at least by ordinary hands. After sorting, the leaves are neatly tied up in bundles called '*hands*,' consisting of four leaves in each bundle of the first class, or six of the second and third classes. The hands are next 'put down to condition,' as the process is commonly termed. This consists in putting it in large bulks and subjecting it to pressure from weights, in which state it undergoes a sweat. It must be watched during this process, and as soon as it is observed beginning to heat, taken out and hung up to dry. After drying thoroughly, it must be again taken down and put into bulk, a damp time being chosen, so as to prevent the leaves from breaking or crumbling. At the close of each day's stripping, and oftener, if the weather is drying, we bulk down what has been stripped, being careful to pack straight. It is left in this situation until we wish to commence pressing, and then hung, from twelve to fifteen bundles on a smooth stick, and hoisted in the barn, the sticks placed six inches apart, the hoister carrying a measure in his hand. It is important to measure, as the order will be more uniform. It should remain until the stems are perfectly dry; after which it should be taken down for pressing, as dry as it can be handled without breaking. It remains in this state a few days, until the leaves are pressed together, and we have soft weather for packing. Each bundle is then carefully straightened, repacked, and heavily weighted It is then ready for pressing. We should press in weather when the order of the tobacco will not change. Each bundle should be straight, and closely packed in hogsheads in the usual way." The press is a long lever weighted with stones.

The hogshead contains from 1100 to 1300 pounds. One hand can attend to 6000 plants, or rather more than an acre, and these will average from 1000 to 1100 pounds of cured tobacco, and commands, if of good quality, seven cents the pound.

New land tobacco and the Orinoko variety are often sun-dried, without any heat; by this means they acquire a rich golden colour, and are of superior excellence for chewing tobacco.

Diseases of Tobacco.—The first difficulty the planter encounters is in the dryness of the season at the time of transplanting, for the young plants will not take except in moist weather and a wet soil. The next is the large horn worm, which increases the expense of cultivation by requiring the attention of pickers, and the wormholes injure the value of the leaves. Hail storms and heavy winds are often causes of damage. Sun burning during cutting and house burning are also sources of loss. But perhaps the greatest cause of loss is firing or *Fire Blight*, which see.

TOBACCO, CHEMICAL REMARKS CONCERNING. The flavour and value of tobacco depend entirely on the sweating or preparation: during this time the fermentation set up converts the fat which it contains into the aromatic principle *nicotin*. If, therefore, the heat is too little, the quantity produced is deficient ; if too great, the volatile nicotin is driven out. The object in curing is, therefore, in the first place, to retain all the fat of the leaf, and in the second, to get the largest quantity of aromatic principle in the prepared tobacco.

Special Manures.—The analysis of tobacco in Europe has brought to light a remarkable fact, that the best varieties contain much potash in their ashes, and the inferior kinds most lime.—(*Pelouze.*) Now these bases in tobacco can replace one another, and the planter will produce lime tobacco in any soil in which that base is more abundant.

One hundred parts of the ashes of leaf tobacco contain, according to Fresenius and Will,

Potash	30·67
Lime and magnesia	33·36
Sulphate of lime (gypsum)	5·60
Chloride of sodium (common salt)	5·95
Phosphates	6·03
Silica	18·39
	100·00

From this, which is the examination of a good specimen, we learn that the plants require not only potash and lime, but gypsum and salt: the former is indeed added with great effect in Virginia ; the latter is very worthy of a trial ; one bushel to the acre in a compost, applied to the plants at the time of hoeing, or three or four bushels to the acre, would no doubt show good effects. Where the New-Jersey green sand, or the ashes of oaks or hickories can be obtained, the potash salts can be procured. In the red clays of Virginia, an addition of lime would unquestionably be serviceable. By these means we meet the demands of the plants for mineral matters ; but it is not to be overlooked that nitrates of potash and ammonia, as well as sal ammonia (*chloride*), have been found in large quantity in the juice : these are destroyed by burning for the ash. Every kind of animal offal and putrescent matter, especially when composted into nitre beds (see *Nitre Beds*), will therefore be indicated as special manures.

TOISE. Six French feet, equal to 6·39 English feet.

TOKAY. A luscious and sprightly wine made from the Tokay grape when nearly dried into raisins.

TOLU. A balsam, from the *Myroxylon toluiferum* of South America.

TOMATO. *Solanum lycopersicum.* An annual of the family *Solanaceæ*, the fruit of which is much used as a vegetable, preserve, and pickle.

The seed is sown in March in a hot-bed, and the plants set out in May along a fence, or near trellises where they can be supported: place them four feet distant. They are to be hoed and weeded, and ripen in August and September. There are four principal varieties, the large red and yellow, the pear-shaped, or fig, and the cherry tomatoes, or small-sized. The soil should be rich, dry, and well exposed to the sun.

TOMENTOSE. Covered with downy hairs.

TON. A weight of 20 cwt., or 2240 pounds.

TONGUE. The soft, fleshy organ of taste. It is covered by nerves and blood-vessels. The salted and dried tongues of deer and oxen are much-esteemed delicacies. They are cured like hams, but usually with more nitre.

TONICS. Those medicines which improve the general health and appetite. They are commonly called bitters.

TONKA BEAN. The fruit of the *Dipterix odorata*, used to flavour snuff.

TONSILS. Small glands situated in the throat.

TOP DRESSING. Applying manures to the surface of land, or to the growing crop, grass, &c. Spring is the proper time, but care should be taken that the soil is not too much pressed in carting.

TORMENTIL. *Potentilla officinalis.* An exotic with an astringent root.

TORREFACTION. Roasting mineral bodies, usually under a red heat.

TORTRICES. A tribe of nocturnal lepidoptera, the larvæ of most of which conceal themselves by rolling up leaves and living in the interior.

TORUS. The end of the flower branch on which the carpels are situated.

TOURMALINE. A gem, valued from its property of polarizing light.

TOURNIQUET. A bandage which may be tightened to any extent by means of a screw, so as to exert pressure upon a cushion, and compress the arterial trunks to which it is applied. It is chiefly used to prevent hemorrhage in the operations of amputation.

TRACHEA. The windpipe.

TRACHEÆ. The spiral vessels of leaves and insects.

TRACHELIDANS. A family of coleoptera, in many of which the head is supported on a kind of neck.

TRACHEOTOMY. The operation of cutting into the windpipe to extract foreign bodies, &c.

TRACHYTE. An ancient lava.

TRAGACANTH. A variety of gum, which swells, but is not soluble in cold water.

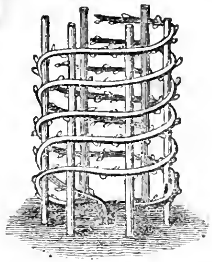
TRAINEAU. A Flemish implement of agriculture. See *Tillage*.

TRAINING. The education of horses. See *Horse*.

TRAINING TREES. The management, by pruning, of the stem and branches of trees, so as to secure an increase of fruit of a superior quality. Training against walls has also the advantage of enabling the orchardist to cultivate southern fruits, and ripen them more perfectly. The chilling effects of winds and excessive evaporation are averted, while the increased temperature to which the fruit is exposed renders it sweeter.

There are three general plans of training: on espaliers, walls, or as dwarf standards. The *espalier* is usually a trellis, consisting of posts ten feet high, set eight or twelve feet apart, and sustaining horizontal laths or wires: the trees are therefore trained horizontally. This is usually intended for grapes, apples, or pears. But the posts are sometimes set in circles, around which three or more branches are trained. This is called spiral or hoop training (see *Fig*. 1).

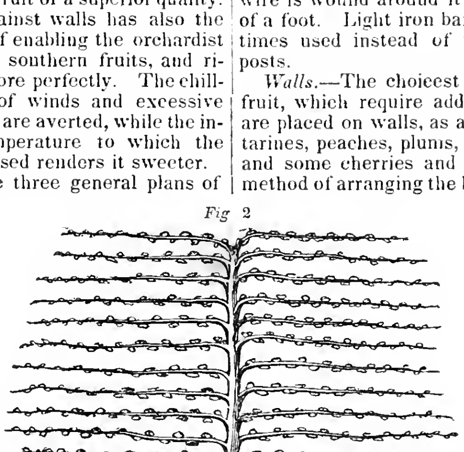
Fig. 1.



Funnel training is a modification, the posts are set in an inclined direction, so as to meet at their summits, and produce the outline of a cone: wire is wound around it at intervals of a foot. Light iron bars are sometimes used instead of the wooden posts.

Walls.—The choicest varieties of fruit, which require additional heat, are placed on walls, as apricots, nectarines, peaches, plums, grapes, figs, and some cherries and pears. The method of arranging the branches dif-

Fig 2

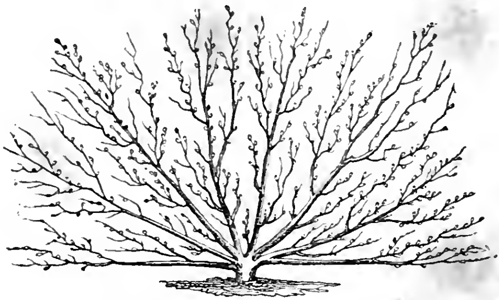


fers with the fruit, but the *horizontal plan* is most recommended, especially for plums and pears; but some gardeners give it the preference in nearly every case (*Fig.* 2).

Fan training is the most common, especially for peaches, nectarines, apricots, almonds, figs, plums, and cherries of small growth (*Fig.* 3).

Besides these most common methods, *pendant*, *vertical*, and *high training* are practised. In the first, the branches are curved downward; in the second, several shoots, selected from two horizontal branches, are carried upright; in the third, the main stem is allowed to run nearly to the top of the wall without branching,

Fig. 3.



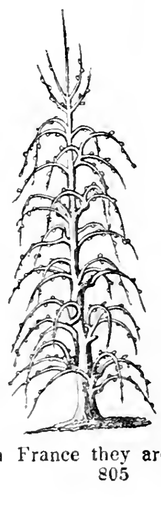
and then the uppermost shoots are trained horizontally and drooping. This is especially recommended in the grape and pear. It is a good plan for filling up a wall, the lower parts of which are covered with peaches and other fan-trained trees.

Some gardeners combine several of these plans together, so as to give the branches partly a horizontal, and partly a fan training, and instead of one main stem only, others select two strong shoots obtained within twelve inches of the ground, and these are trained outward by placing a hoop between them: when they are well formed, they are trained curving upward. The centre is to be kept free, and the shoots encouraged to six feet; the small lateral branches along these shoots are to be kept down to six inches, and will bear the fruit.

Standards.—The commonest training for standards is *dwarfing*. The leading shoot is kept down to eight or ten feet, and the lower branches trained out and thinned, so as to give the tree the appearance of a shrub. In this way apple orchards are managed in Europe, and it is wonderful how many varieties are thus cultivated on an acre. For this purpose, crab or paradise stocks are chosen for grafting, and the trees of small growth taken. The main stem is made to branch at eighteen inches, and the trees set at eight to twelve feet apart.

The filbert is trained in a peculiar manner: the leading shoot is headed down to eighteen inches, and eight

Fig. 4.



Training en quenouille, or distaff fashion, is a favourite method in France and Brussels for apples and pears (*Figure* 4). The branches are tied down to stakes driven near the root, or to the stem, until the wood is firm. The height of these trees is usually eight feet, but in France they are sometimes allowed to grow to twenty feet.

Another French plan of training standards is in a pyramidal form (*en pyramide*, *Fig.* 5); this, with the pre-

Fig. 5.

ceding, is the common method of managing apples and pears. The tree is either cut down to a dwarf of eight or ten feet, or allowed to run up to twenty or more.

TRAM ROAD. A road set with stone flags at such distances that the wheels of wagons, &c., may continually roll on them.

TRANSITION ROCKS. The extensive series of stratified and ancient rocks lying between the granitic series and the coal. It consists of slates, gneiss, and crystalline limestones.

TRANSPLANTING. The removal of plants or trees from one place to another. See *Planting*.

TRAPA NATANS. The water-chestnut.

TRAP ROCKS. Ancient rocks of fusion occurring in mountains and large seams. They consist of various mixtures of hornblend and feldspar, and when containing much iron are very destructible, but usually resist the action of weather for an immense time.

TRAUMATIC (from τραυμα, *a wound*). Relating to or arising from a wound.

TRAVELLER'S JOY. *Clematis vitalba.* A climbing shrub with white flowers.

TREFOIL. A general name for the clovers, lucern, &c. Plants which have leaves of three leaflets.

TRENCH. A deep ditch. Trenching, in gardening, is the preparation of soils by digging two or more spades deep, and exposing the soil.

TRENCH PLOUGHING. Deep ploughing; subsoiling.

TREPAN and TREPHINE. Instruments for removing a part of the skull in disease or accidents.

TRIFOLIUM. *Trifolium incarnatum.* "This is an annual of rapid growth, so that in southern climates it may be sowed in summer after an early crop of corn, and fed off or cut before winter. It will stand the winter well if sowed later, and give very early feed in spring. It produces a great abundance of seed if allowed to ripen. It is a valuable addition to the plants usually raised for fodder, and fills up an interval between other plants by its very early and rapid vegetation. The mode of sowing the *Trifolium incarnatum* is simple, and attended with very little expense. In the month of August, as soon as the crops of grain have been reaped, the stubble is well harrowed, to raise a small portion of mould; the trifolium is then sowed at the rate of four bushels of the seed, in the husk, per acre. There is a double advantage in sowing it in this manner; it saves the thrashing required to separate the seed, as a very slight beating will separate the florets of the head or spike sufficiently to sow them; and it vegetates sooner from the moisture retained in the husk which envelopes the seed. A bush-harrow is drawn over the land to cover the seed, and it is rolled with a light roller if the land be of a firm nature, or with a heavier roller if it be a loose soil. Thus the trifolium will vegetate much more certainly than if the land had been regularly ploughed and harrowed, which would have loosened it too much.

"It is not advantageous to let it be

cut for hay. Its stem then has acquired a hard, woody texture, and it makes very inferior hay. Its principal value is to feed off with ewes and lambs before other feed is ready in spring, or to cut it green for horses and cattle. The ground may be ploughed and prepared for spring crops as early as is required; and thus the trifolium in no way interferes with the usual rotations. When the common broad clover has failed from any cause, and bare patches are left in the fields in autumn, the trifolium may be sowed there with advantage; it will overtake the clover sowed in the preceding spring, and fill up the deficiency. In this case a mixture of *Trifolium incarnatum* and Italian rye grass (*Lolium perenne Italicum*) has been found very useful. If the trifolium be sowed early in spring, it will produce very good feed in a few months, and the land may afterward be sowed with turnips, without any loss of time. It must be recollected that the *Trifolium incarnatum* is a catch crop, that is, one which comes in between two regular crops, without interfering with the rotation, and that it costs little more than the seed, which is easily raised, or may be bought at a very moderate rate. All cattle are fond of it in its young state, and it comes in a fortnight earlier than lucern, which is one of the first of the artificial grasses fit for cutting in spring. The great expectations raised at its first introduction not having been fully realized, this plant has rather fallen in the estimation of farmers; but if it is not so valuable as the broad clover in a regular rotation, it ought not to be despised as a subsidiary crop. When the season has prevented the sowing of spring corn, it may be advantageous to sow it together with Italian rye grass, as soon as the land is clear of rootweeds. They may e fed off with sheep early in autumn, and the land, being manured or not, as may be thought necessary, may be ploughed and sowed with wheat. Thus the trifolium and rye grass will come in the place of a clean fallow; and the ground having been covered during the heat of the summer, and manured by the sheep folded on it, will be much improved for the wheat crop. It must be remembered that the trifolium requires a solid bottom, and that the heavy roller should not be spared before it is sowed. This is chiefly to be recommended on soils which do not suit spring tares, and as a substitute for these; for under favourable circumstances the tares will produce the greatest quantity of feed. It is, however, useful to have a choice of different green crops, from which may be selected those which offer the greatest prospect of success, when the season, the soil, and other circumstances are taken into consideration."

TRIMERANS. A section of coleoptera, in many of which the tarsus contains three joints.

TRIMMER. In building, a piece of timber framed at right angles to the joists opposite chimneys or the well holes of stairs, which receives the ends of the joists intercepted by the opening.

TRIMMING JOIST. In building, a joist into which a trimmer is framed.

TRIPLE SALT. A salt with two bases combined with one acid.

TRISMUS. Locked jaw.

TROCAR. An instrument for letting out water in dropsies, wind in hoven, &c. It consists of a sharp rod of metal contained within a case or tube of silver up to the sharp portion. When used, the tube is separated in part from the rod and held against the part, and then the rod is driven in so as to penetrate into the cavity, and, on being withdrawn, the tube is pressed into the perforation, and enables the fluid to escape perfectly.

TRONA. The impure carbonate of soda, or natron.

TROPHI (from τρεφω, *I nourish*). A name given to the different instruments or organs contained in the mouth or closing it, and employed in manducation or deglutition. They include the *labrum*, *labium*, *mandibulæ*, *maxillæ*, *lingua*, and *pharynx*.

TRUCK. A kind of wheel-barrow.

TRUFFLE. "A subterranean fungus, of a roundish, oblong form, and a blackish brown colour, much employed in cookery. It is found by dogs and pigs, trained for the purpose, in soil beneath trees, especially beeches and oaks; it is, however, very local. It is propagated by spores included in sinuous chambers in the interior; but has never yet been cultivated with success, notwithstanding many attempts that have been made. Botanists recognise several kinds of truffles, the commonest being the *Tuber cibarium*."—(*Lindley*.)

TRUNCATED. With the smaller parts cut off or removed.

TRUNCHEONS. Stout stems of trees, with the branches lopped off for rapid growth.

TRUNK. The shaft of a column; the body without extremities; the large stem of a tree. In entomology, the segment which lies between the head and the abdomen.

TRUSS. A bundle of hay or straw: the truss of hay weighs 56 lbs., of straw 36. A frame of timbers for supporting a beam or piece. Any bandage intended to support a part of the body, as in hernias.

TUBE. A pipe.

TUBER. In botany, a kind of fleshy stem, formed under ground, and filled with starch. It is commonly looked upon as a root, as in the potato, but differs from roots in having buds.

TUBERCLE. A roundish tumour of small size, and of the consistence of cheese, found in diseased structures.

TUCKAHOE. Indian loaf. An underground fungus, often two feet deep, but sometimes partly exposed, and from the size of a nut to a man's head, roundish, and of a brown colour. It is the *Lycoperdon solidus* of Clayton. When fresh, it is of an acrid taste, but becomes eatable when dry.

TUFA. A volcanic rock, consisting of cemented scoriæ.

TUFO. A light, calcareous stone.

TULIP. The genus *Tulipa*, containing numerous ornamental species: they are all bulbous.

TULIP-TREE. *Liriodendron tulipifera*. White wood. It attains a great size on fertile bottoms, measuring even 150 feet in the Middle States, with a trunk of sixty to eighty feet without branches. The flowers are very attractive to bees and other insects. The wood is white or yellowish, and very soft; it is much used by cabinet-makers and in building, under the name of poplar.

TUMBREL. A rough cart.

TUMBRIL. A feeding trough made of basket-work, or withes, set coarse, so that many sheep can take hay from it at the same time.

TUMOUR. An unnatural enlargement. This term was formerly used to express any swelling or enlargement, as that of an abscess, or from a bruise; but it is now more strictly applied to enlargements of a more permanent nature, in which a change of structure takes place, or a new substance is produced, as fatty, fibrous, or bony tumours, in which the swellings are respectively formed of fatty, fibrous, or osseous matters. These being organic diseases, are not to be treated by poulticing or lancing, and seldom give way to any treatment but an entire removal by the knife.

TUN. A measure of 252 gallons, or four hogsheads.

TUNIC, TUNICA. A membrane or coat covering an organ.

TUPELO. The name given by Michaux to several species of *Nyssa*, or black gum.

TURBINATE. Whirled, and of a conical figure.

TURF. "The sod which covers the surface of pastures. The word is often also applied to the substance which is generally called *peat*. We shall here notice the uses to which turf is applied, when we mean a sod taken from the surface on which some living plants are still growing, or have lately done so. Near extensive heaths which have never been reclaimed, and in situations where no regular peat-bogs are to be found, turf becomes a very useful fuel. It is pared off the surface with the heath growing on it, in dry weather, in sods of a convenient size, generally round and about one foot in diameter. The thickness of the sod depends on the depth and abundance of the roots found in it, as they are the sole cause of the turf continuing to burn when the blaze caused by the burning of the heath is over. As the soil of the places where turf is usually cut is generally of a sandy nature, turf ashes are not so valuable for manuring the land as peat ashes; still they contain portions of potash and other vegetable salts, and produce a very good effect when spread as a top-dressing on moist meadows the soil of which is chiefly composed of clay.

"Turf is used for many other purposes, as well as for fuel; laid like tiles on a roof, overlapping each other, they form an excellent and cheap protection against rain; cut somewhat thicker, and in the shape of bricks, they serve to build walls, which are durable.

"The surface of good pastures, especially of commons, is often pared for the purpose of forming an artificial turf for ornament, or for the purposes of pasture. In the first case, those spots are chosen where the grass is of the finest and closest pile. The surface is pared as thin as can conveniently be done, so that the sward shall not break. A proper spot having been chosen, it is divided by the spade, or some sharp instrument like a knife stuck across a long handle, into strips about a foot wide; and a very sharp flat instrument with a bent handle, so as to work horizontally, is thrust an inch, or a little more, below the surface, paring off the strip which has been marked. As the workman who cuts the sod advances, another rolls it up before him, until it is of a proper size to be carried off. A cut is then made across the strip, and another roll is begun. Thus a large space may be completely bared, or parallel strips may be cut out, leaving some of the turf uncut between them. In this case the loss of the herbage will be soonest repaired by the spreading of the grasses from the strips which are left. When an ornamental lawn is to be formed by laying down the turf, the ground is levelled, or laid in any desired form. It is well rolled and beaten, to make it firm; and if the weather is dry, it is well watered before the turf is applied. As lawns require frequent mowing, a close, slow-growing turf is a great advantage; it should therefore be taken, if possible, from a poor, thin soil. If the ground to be covered is of a rich quality, it is best to remove the soil and lay some of the poorer subsoil bare, to place the turf on: a rich moist soil would make the grass grow too rank, and require constant mowing and rolling to keep it down. Brickbats and rubbish are often spread over the ground, where a lawn is to be formed by turfing it over: these not only form a poorer soil, but also keep it drier by their porosity. It need not be observed, that where turfing is resorted to, to cover bare places in meadows or pasture, the reverse of all this should be done, and manure spread over the places where the turf is to be laid, so that the roots may be invigorated and a rich pile of grass may spring up.

"When there are banks and inequalities in pastures, it is often useful to pare off all the turf, rolling it up from the places which are to be levelled. The superfluous soil is then removed, and if it has been long in the form of a dry bank, it is spread over the grass, which it greatly invigorates. The new surface is enriched with manure if it requires it, and in moist weather, or after watering it, the turf is unrolled over it and well beaten down. A heavy roller drawn over it will greatly assist its rooting, and thus an unsightly bank, on which the grass was usually either coarse or burned up, according as the season was wet or dry, becomes a good and neat pasture. Another important use of turf is to cut it into small strips and divide these into pieces of a square inch in size, or somewhat more, for the purpose of laying land to grass by *inoculation*. This is only a partial turfing, which extends rapidly, and, in the course of a very few years, converts a field which was not very productive, as arable land, into a valuable meadow, especially if it is so situated as to be capable of occasional irrigation."

TURKEY. See *Poultry*.

TURMERIC. "The root of the *Curcuma longa*. This root yields a fine yellow powder, which is occasionally used as a dye-stuff in medicine; it also forms one of the ingredients of *curry powder*. Paper stained with turmeric is often used in the chemical laboratory as a test of the presence of free alkalies and their carbonates, by which its yellow colour is converted to brown."

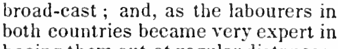
TURNER'S CERATE. It is made by melting half a pound of yellow wax with two pounds of lard, and, when cool, working into the mixture half a pound of prepared calamine. It is used to excoriations, or galled places, burns, and is a mild astringent.

TURNIP. *Brassica rapa*. "This well-known plant is cultivated for its bulbous roots, both in the garden and the field. As a culinary root it has been prized from the earliest times, and many varieties have been cultivated for the table; but it is those of a larger kind, cultivated in the fields, which form so important a part of the most improved systems of agriculture on all light soils, that the success of the farmer is, in general, proportioned to the quantity of turnips raised on his farm. They are the great foundation of all the best systems of cropping, by supplying the manure required for the subsequent crop, and, at the same time, clearing the land of all noxious weeds, by the numerous ploughings, stirrings, and hoeings which they require.

"Turnips were first raised upon land which had already borne a crop that was reaped early in summer, and on fallows which had been worked and cleared early, so as to leave a sufficient interval between the last ploughing and the time of sowing winter corn to have a tolerable crop of turnips. These turnips, however, which are still cultivated by the name of stubble, or eddish turnips, never grow so large as those which had been sown earlier on land well prepared and highly manured.

"The regular cultivation of turnips on a large scale was originally introduced from Flanders into Norfolk two centuries ago. It was long confined to one or two individuals, who cultivated turnips very successfully; but at last it spread, and was greatly improved by introducing the row culture, according to Tull's system, which acquired the name of the Northumberland mode of cultivation. The usual mode of sowing turnips, both in Flanders and in Norfolk, was broad-cast; and, as the labourers in both countries became very expert in hoeing them out at regular distances, this mode was long preferred. In fact, the cultivation of turnips in rows is scarcely practised at all in Flanders, and, notwithstanding its evident superiority in respect to quantity of produce and economy of labour, it cannot be said to be yet universally adopted. The Northumberland method of cultivating the crop, which is particularly adapted to moist, cold, or tenacious soils, or to farms where manure is scarce, and which is mostly managed with but little use of the hand hoe, is illustrated by the following cuts:

Fig. 1.

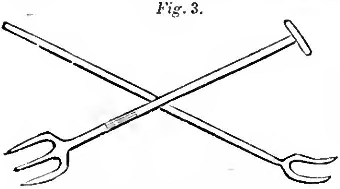


"*Fig.* 1 shows a transverse section of the ground when prepared for receiving the manure, it being gathered in one-bout ridgelets. The dung carts pass lengthwise, and the dung is dropped, or pulled out into the furrows: lads follow the carts and spread out the dung from the little heaps along the hollow of each drill. The horse with the loaded cart walks in the interval of the ridges, so that a wheel of the cart shall go in each of the hollows of the two ridges adjoining. The person who directs the horse follows the cart, which is open behind, and with a crooked two-pronged fork, or dung-hack (*Fig.* 2), drags

Fig. 2.

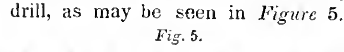
out the dung, as the horse moves along, into little heaps in the hollow of every third ridge, at the distance from each other of from eight to ten feet. Behind follow three young persons, with each a two-pronged or three-pronged fork (*Fig.* 3), each walk-

Fig. 3.



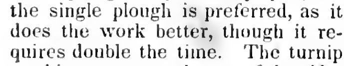
ing in the interval of a ridge, and spreading out the dung in as regular a manner as possible, as a cross section of the ridgelets with the dung deposited in the intervals would show (*Fig.* 4). It is immediately covered

Fig. 4.



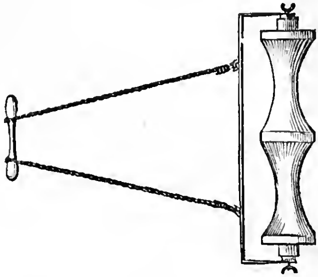
by the plough, which, passing down the middle of each ridgelet, splits it into two, so that a new drill is formed, whose top is immediately above the former hollow of the old drill, as may be seen in *Figure* 5.

Fig. 5.



For this purpose, the double mouldboard plough may be employed, but the single plough is preferred, as it does the work better, though it requires double the time. The turnip seed is sown upon the top of the ridges, above the manure, with a horse or hand drill, the former of which has a roller, which precedes the coulters and flattens the ridges. When the seed is sown by hand, a hand roller is drawn over the ridges (*Fig.* 6).

Fig. 6.



"As soon as the plants have assumed what is termed the rough leaf, and are about two inches in height, the process of hoeing commences. This is done by turning first a light shallow furrow from the plants, or by the horse hoe, or cultivator with lateral coulters.

"The great object on poor light lands, especially those which have lately been brought into cultivation, is to raise a crop of turnips; for when once this is obtained, and the land has been improved by the folding of sheep upon it, there is no great difficulty in maintaining the fertility thus produced by judicious management and frequent green crops. Great improvement in poor soils has been effected by the introduction of ground bones as a manure, which have the peculiar property of favouring the growth of the turnip, and have consequently been used on poor light sands and gravels to a great extent, and with unvaried success, without much help from farm-yard manure. It has, however, been found that a much greater profit is obtained from the land by uniting the regular application of farm-yard dung with that of the bone dust. For this purpose, the best farmers prepare their land, where they intend to sow turnips, early after harvest, by giving it as complete a cultivation as they can before winter; and they put on it a good coat of manure and plough it in. In the beginning of summer another ploughing is given, with repeated harrowings, to destroy the weeds which have sprung up. If the subsoil is dry, or the land has been thoroughly drained, the seed may be drilled in rows from two feet to thirty inches apart, with bones or any equivalent artificial manure on the flat surface: a pound of seed the acre is a good allowance. The turnip seed can scarcely fail to vegetate soon. Less danger arises from dry weather than if they were on the top of a ridge, and the intervals can be readily stirred by the plough, or any other instrument adapted to the purpose. The manure, which has had time to incorporate with the soil and to impart to it the various gaseous products of its decomposition, is in the best state to nourish the young plant, until it can push forth its roots; a more rapid growth is ensured, which is the best preservative against the fly; and experience has proved that this is a much more certain way to ensure a good crop of turnips, especially of Swedes, than the old method of putting all the manure immediately under the seed in the rows, where it often remains inert if dry weather comes on soon after the seed is sown. The quantity of manure put on in autumn, or very early in spring, depends on the means of the farm. If ten cubic yards of short dung can be afforded per acre, the crop of turnips will amply repay it; and twenty bushels of bone dust or less per acre will be sufficient to drill with the seed. Long fresh manure may be safely ploughed in before winter, which would be very improper in a light soil if used in summer. This will be rotten before the turnips are sown, and all the expense of forming dunghills and turning them over is saved. Where farm-yard manure is scarce, half the above quantity may be used, and a fair crop of turnips may still be expected. We have ourselves followed this method with abundant manure, and also with half the usual quantity, the success being always in proportion to the quantity of farmyard manure.

"The early vegetation of the seed is essential to a goop crop of turnips. In its young and tender state it is liable to a variety of accidents. Its great enemy is the turnip fly (*Haltica nemorum*), which appears always in great quantities if there is any continuance of dry weather. The more frequently turnips are sown n the same ground, the more abundant is the fly; but where the surface has been pared and burned there is seldom any loss from this cause. It is generally found that in moist weather the fly does comparatively little harm, as then the vegetation is rapid, and the plant, when once it has put forth its rough leaves, is considered safe. Whatever, therefore, accelerates the vegetation will secure the growth of the turnip. In very dry seasons, if water is at hand, it is well worth while to water the newly-sown rows by means of a common water-cart; and if some liquid manure be mixed with the water, the effect will be astonishing. By means of two leathern hose two rows may readily be watered at once; and if the pond or stream be not above half a mile off, a vast extent of ground may thus be watered in one day. Nothing brings on vegetation so fast as diluted liquid manure, care being taken that it be not too strong. The best time for watering is in the evening, or early in the morning; and if in a fine summer's night the water-cart were used before daylight, there would be no great inconvenience to the horse or his driver. It sometimes happens in soils rather compact, that a crust is formed on the surface which has been harrowed fine and rolled, and this impedes the vegetation by excluding the air necessary to germination. In this case, no better remedy can be applied than watering, which softens the crust and lets the young plant through. As soon as the turnip plant has put forth its rough leaves, the intervals between the rows should be stirred with a light plough drawn up by one horse. The plough can be made to go within an inch or two of the plants, throwing the earth from the row into the interval: a small harrow, which can be set to any required width, is then drawn between the rows, to loosen the earth raised by the plough: this greatly increases the absorption of moisture, and invigorates the young plants. They may now be thinned out in the rows by means of a hoe about twelve inches broad. See *Fig. 7: a* is the blade, which will hoe out all

Fig. 7.

the superfluous plants, leaving little tufts a foot or more apart. These tufts are thinned out by hand, leaving only one healthy plant in each. Thus the turnips are left at a proper distance, and, having ample room, will soon cover the rows. A horse-hoe is now drawn between the rows, to eradicate all weeds and keep the soil open for the fibres of the roots to shoot in. It is not advisable to throw the earth over the turnips, unless it be just before winter, to protect them from the frost; on the contrary, in wet weather the earth is more likely to cause the turnip to rot than to help its growth. The fibres which draw the nourishment strike in the soil below, and spread between the rows wherever they meet with a loose and mellow earth.

"In order to have a heavy crop, especially of Swedish turnips, or *ruta baga*, it is advisable to sow the seed early, that is, in the beginning of July; they will then have the advantage of the summer showers, and be beyond the reach of the fly in a very few days; and when the dry weather sets in, they will already have a supply of moisture in their roots, and the fibres, having struck deep, will not suffer any check. The only inconvenience of sowing early is, that many of the plants are apt to run to seed. This is in many cases owing to the seed which is used. If the seed has been raised from fine roots which have stood the winter, there is little danger of the plants running to seed in the first summer; but, as is often the case, if small, imperfect roots are taken, or those which run to seed in autumn, then the plants will have a tendency to produce seed, and not bulbs. The white Norfolk turnip and its varieties should be sown about midsummer, to have a good and heavy crop before winter. The distance at which they may be left in thinning them out must depend on the variety, whether it has a wide-spreading top or not. The best crops, both of Swedes and common field turnips, are generally those where the tops are vigorous and moderately spreading. A small top will not nourish a large bulb; but when the growth is chiefly in the leaves, the bulbs are seldom large.

"It may be considered as a general rule, that the most advantageous mode of consuming turnips is to draw them and cut them in slices in the field, to be there consumed in troughs by sheep, to whom corn or oil-cake, as well as hay, is regularly given. When the crop of turnips is abundant, part of them may be stored for the cattle in the yard or fatting-stalls, and for the milch cows and heifers. They will require nothing but good straw, if they have plenty of turnips, and no hay whatever need be used, unless it be for the horses; and even they will thrive well on Swedish turnips and straw, with a small quantity of oats. Turnips are often left in the field all the winter, which greatly deteriorates them. If they cannot all be fed off before December, they should be taken up, with the tops on, and set close together, covered with the tops, on a piece of grass, or in some dry spot. They will thus be quite sufficiently protected from the frost; or the tops may be cut off within an inch of the crown of the root; and they may be stored in long camps five feet wide and four feet high, sloped like the roof of a house, and covered with straw and earth, in which state they will keep till they are wanted. It is advantageous to have different varieties of turnips, which will come to perfection in succession; and it is useful to sow some at different times for this purpose.

The small turnip, which from its rapid growth is called the nimble turnip, may be sown as late as the end of August, and in the mild seasons of the Middle States will produce tolerable bulbs in winter and early in spring. The frost will not injure a growing turnip so readily as one which is come to perfection, and the leaves of which are withered. Some varieties, like the yellow Aberdeen and the green round turnip, are hardier than others, and will stand the winter well in a light and dry soil."

The method of taking up the crop for winter store is by running a furrow along the rows, and turning the earth from the roots; the turnips can then be pulled by the hand, or with the hook (*Fig.* 8).

The following account of the product and profits of ruta baga is by Judge Buel:

"*Profits.*—From many years' experience, we estimate as an average product, under good management, 600 bushels to the acre. We may assume the following as the average expense of cultivating and harvesting an acre:

One ploughing and a thorough harrowing	$2 50
20 wagon loads manure, at 75 cents	15 00
1 pound seed	1 00
1 day spreading manure and drilling seed	0 75
3 dressings with cultivator, man and horse one day	1 25
2 dressings with hoe, six days, 6*s.*	4 50
5 days harvesting and pulling, 6*s.*	3 75
	$28 75

which divided by 600, the number of bushels, would bring the cost of the roots below five cents the bushel. But if we abate half the cost of the manure for the after crops, and allow a fair consideration for the tops, say $5, it will reduce the cost of the roots to less than three cents a bushel. Now a cow or bullock will do well and thrive upon two bushels a day; hence an acre will afford 300 daily rations, or maintain five cows 60 days, at the actual cost of $16 25, or $3 25 for each the two months. Let us contrast this expense with that of feeding hay. We believe a ration of hay is 28 lbs. Let us suppose it to be 25 lbs. Then, to keep the five cows 60 days would require 7500 lbs., or 3 tons 15 cwt. of hay, which, at a fair medium price of $10 a ton, would amount to $37 50, making a difference in favour of the turnips of $21 25, or nearly three fifths. Let us test the relative profits in another way. The average product of our grass lands is about two tons the acre; say the product of two acres would be 7500 lbs.; then the product of an acre in ruta baga would go about as far in feeding stock as the product of two acres in meadow; with the farther advantage, where the turnips are sown upon a young clover lay, that one half the hay may also be cut from the acre which produces the 600 bushels of turnips, the latter being raised as a second crop."

"There are so many varieties cultivated that it is difficult to enumerate them. The Swedish turnips may be classed according to the colour and size of their tops and the shape of the bulb. The best have but little stem rising from the bulb, and a good tuft of leaves. The substance of the turnips is of a bright yellow, and has a strong smell, especially when they have been kept some time. No frost will hurt them, if they are kept dry; but alternate rain and frost will do them harm. When they are stored, it is advantageous that the air should have free access; and for this purpose it has been recommended to place them between hurdles set upright, and to slightly thatch them with straw to keep out the rain. In this way they keep longer sound than when put in camps covered with straw and earth.

"Of the field turnip there are numerous varieties. The common Norfolk turnip is round and flat, the bulb being half buried in the ground; it throws out no fibres, except from the slender root which proceeds from the centre of the bulb. There is a subvariety which is reddish at the insertion of the leaves, and another of a green hue; the latter is the hardiest. The globe turnip takes its name from its shape; it rises more out of the ground, and grows to a greater size; like the last, it is either entirely white or red, or green near the crown. It is, on the whole, the most productive and hardy. The tankard turnip rises high out of the ground, and approaches in shape to the mangel wurzel. It grows to the greatest size; but it is apt to become spongy if left long on the ground, and its weight is not in proportion to its bulk. There are red tankards and green tankards, as well as white. The green round turnip is considered very hardy, and is usually sown late, to be consumed after the winter. The yellow Aberdeen, although somewhat less, is compact, and stands the winter well; it is a very useful variety.

"Next to those above mentioned come the smaller turnips of quicker growth, which have mostly been taken from the garden. They should not be sown early, as they are very apt to run to seed in dry weather; but in a moist climate they may be sown at any time in the summer, and they will be in perfection in three months. Thus they may be made to fill up the interval between the early rye or trifolium fed off in spring, and the wheat sown in autumn.

"Those who are possessed of a good variety will do well to raise their own seed, as that which is bought cannot always be depended upon for this purpose; the best-shaped, middle-sized bulbs should be chosen, the leaves being cut off not nearer than an inch from the crown. They should be planted in a mellow soil, in rows three feet wide, and a foot from bulb to bulb in the rows, about March or April. When the pods are well filled with seeds, and these are round and hard, the stem should be cut close to the root and carefully laid under a shed to dry. The seed will ripen there without shedding, and when the pods are quite dry, the seed is easily beaten out with a stick or light flail. Birds are so fond of it that a constant watch must be kept; and this is the reason why so few farmers grow their own seed. Turnip seed is often raised in the gardens, and is a branch of industry which every farmer should encourage. He can readily see that good bulbs only are used, and he secures the seeds he wants. If the seed is kept in a dry granary, it will be good for several years. It is, however, best to use fresh seed, as it always germinates sooner. The seed is seldom steeped, but generally drilled in the rows by a drill-barrow or more perfect sowing machine. The best farmers, even on land well manured and in good heart, sow with the seed some artificial manure, as bones, rape cake, or rich dried compost, to accelerate the first growth of the plants."

Diseases.—"The diseases and injuries to which turnips are liable are various. At their first appearance their leaves are liable to the attacks of the fly (*Aphis* and *Haltica*), the caterpillar, the slug, and the mildew. Their bulbs and roots are attacked by worms of different kinds; by a singular tendency to monstrosity, known provincially by the name of fingers and toes; by the anbury; by canker, and by wasting or gangrene from water or frost. Of all or most of these injurious diseases, it may be observed, that they admit neither of prevention nor cure by art. Under favourable circumstances of soil, climate, culture, and weather, they seldom occur; therefore, all that the cultivator can do is to prepare and manure his land properly, and in the sowing season supply water when the weather is deficient in showers or the soil in humidity.

"The fly (*Haltica*) attacks the turnip when in the seed leaf, and either totally devours it, or partially eats the leaves and centre bud, so as to impede the progress of the plants to the second or rough leaves. Whether the eggs of these flies are deposited on the plants or in the soil, does not appear to be ascertained; in all probability they are attached to the former, as in the gooseberry caterpillar, and most cases of flies and insects which feed on plants. Preparations and mixtures of the seed, as already treated of, are all that have yet been done in the way of preventive to this evil.

"The caterpillar makes its appearance after the plants have produced three or more rough leaves; these they eat through, and either destroy or greatly impede the progress of the plants. There can be little doubt that the eggs of these caterpillars are deposited on the leaves of the plants by a species of moth, as the caterpillar may be detected when not larger in diameter than a hair. As preventives to the moths from fixing on the turnips for a depository for their eggs, it has been proposed to place vessels with tar in different parts of the field, the smell of which is known to be very offensive to moths and all insects; or to cause a thick offensive smoke from straw or weeds to pass over the ground at the time when it is supposed the moths or parent flies are about to commence their operations. To destroy the caterpillar itself, watering with tobacco water, lime-water, strong brine, and laying on ashes, barley awns, &c., have been proposed.

"The slug and snail attack the plants both above and under ground, and eat both the leaves and roots. Rolling, soot, quicklime, awns, &c., have been proposed to annoy them; but the only effectual mode is, immediately after the turnips are sown, to strew the ground with cabbage leaves, or leaves of any of the *Brassica* tribe. On these, especially if sweet from incipient decay, the slugs will pasture, and may be gathered off by women or children every morning. If as many cabbage leaves, or handfuls of decaying pea haulm, or any similar vegetable, be procured as will go over a ridge or two, say at the rate of a leaf to every square yard, a whole field may soon be cleared by picking off the slugs and removing the leaves once in 24 hours. This mode we have found most effectual, and it is extensively practised by market and other gardeners.

"The mildew and blight attack the turnip in different stages of its progress, and always retard its growth. Its effects may be palliated by watering and strewing the leaves with sulphur; but this will hardly be considered applicable to whole fields.

"The worms attack the roots, and, when they commence their ravages at an early period, impede their growth, and ruin or greatly injure the crop. They admit of no remedy or prevention.

"The forked excrescences known as fingers and toes in some places, and as the anbury in others, are considered an alarming disease, and hitherto it can neither be guarded against nor cured." See *Anbury*.

TURNIP CABBAGE. The kohl rabi.

TURNIP CART. "This is an ingenious adaptation of the disk turnip cutter to the turnip cart. The disk is put in motion by a face-wheel fixed upon the nave of the cart-wheel, which, as it revolves, communicates by means of cog wheels with the axis of the cutting plate. It offers a very convenient mode of feeding sheep on pastures or lawns, and was introduced about the year 1834 by Arthur Biddell, farmer, of Playford, the inventor of the well-known scarifier which bears his name."—(*Johnson.*)

TURNIP CUTTERS. In feeding sheep and stock with turnips, as well as other roots, it is necessary to cut them into small pieces to hinder choking and facilitate digestion. For oxen and pigs, it may be better to steam them; but for sheep, the common practice is to cut them. The simplest form of *vegetable cutter* is like the simplest straw cutter, two or more knives set in a lever and worked upon a table (*Fig.* 1); but this is a slow machine, and has been, for the most part, superseded by implements of the construction shown in *Fig.* 2, which consists of a side hopper, containing the roots, and a wheel set with blades on two or more of its spokes. As these are revolved before the bottom of the hopper, the turnips or other roots are cut into slices and fall below. The upright position of the hopper constantly brings down more of the vegetables. In *Gardner's* improved machine, two spokes are set with knives at right angles with the former, which split the slices into small pieces as they are cut by the long knives.

Fig. 1.

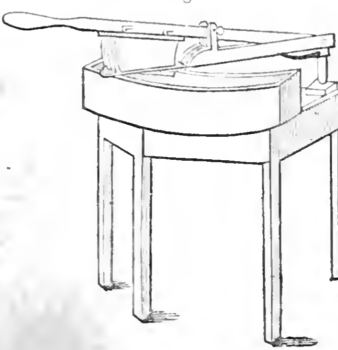
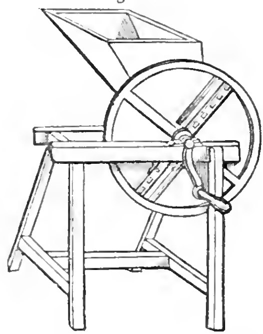


Fig. 2.



TURNSOL. Litmus.

TURPENTINE. The resinous sap of pine-trees, especially of the *Pinus australis*, the long-leaved or southern pine, abounding in the sandy barrens of the Southern States. It is procured by making an excavation in winter of the size of about three pints in the stem, near the ground; from the upper part of this the turpentine exudes during spring, summer, and fall, and is received into gourds or other vessels, and emptied into barrels, which are exposed to dry, and then headed and shipped. It is a useful application to many wounds. The *oil*, or *spirit*, is obtained by distilling crude turpentine with water; the spirit passes over, and common rosin remains in the still. It is rectified or redistilled for commerce.

TUSSAC GRASS. *Dactylis cæspitosa.* Falkland Island grass. A large, sedgy grass, growing on the seashore of those islands. It is very nutritious and hardy, 150 acres fattening 250 cattle and 70 horses during the winter. The grass grows to a great height, and maintains its verdure even in winter. Governor Moody of the islands found it would grow on high and dry land if the stools were set out in spring. It bears three cuttings per annum; is perennial. If seed be sown, it requires three years to arrive at maturity.

TUSSOCKS OF GRASS. Clumps or hillocks of growing grass.

TYMPANUM. The membrane of the ear which receives the vibrations of sound.

TYPES. In chemistry, a certain number of elements combined together, every one of which may be replaced by another, and, indeed, every one in its turn, the arrangement of the elements in every case remaining always the same with regard to each other, the type being no precise compound, but the manner of grouping. The new compounds (as when chlorine replaces hydrogen) have often the same properties as the original.

TYPHUS. Continued fevers, attended with great debility. They arise from impure air, bad food, &c., and are therefore often epidemic. *Typhoid* fevers are those in which there is a tendency to great debility.

TWITCH GRASS. Couch grass.

U.

UDDER. The milk-secreting gland of the cow.

ULCER. An open sore discharging matter. Ulcers sometimes become torpid and difficult to heal, in which case stimulants are used. The application of caustic is necessary when there is fungous growth; the nitrate of silver or red precipitate is best. Calomel is extremely serviceable to heal healthy ulcers: tar is also used for this purpose.

ULTIMATE ANALYSIS. The determination of the elements of an organic body. See *Organic Analysis.*

UMBEL. In botany, a form of inflorescence in which all the pedicels proceed from a single point. If there is no subdivision, the umbel is called simple; but if the pedicels produce other umbels, as in parsley, the umbel is compound.

UMBELLIFERÆ, UMBELLIFEROUS PLANTS. They are a race of great frequency in all cool or temperate climates, and even occur in hot ones, though much more rarely. They are known in general by their flowers being disposed in an umbel. They have an herbaceous stem; leaves usually much divided, often inflated when they join the stem; and they have universally a dry fruit, which divides into two seedlike pieces. Some of them are poisonous, as hemlock, fool's parsley, and water dropwort; others are esculents, as celery, carrots, and parsnips; many yield aromatic fruits, as caraway, coriander, and anise; a few secrete a fœtid gum resin, of which asafœtida, ammoniacum, and galbanum are examples. The species are extremely numerous, and difficult to recognise with accuracy; and, unfortunately, no general rule has yet been discovered for distinguishing the poisonous from the harmless kinds; but those which grow in damp or wet places are to be suspected, whereas those that are aromatic and found in dry soils are often innocuous.

UMBILICAL CORD. In animals, the cord of blood-vessels which passes between the placenta and fœtus; the navel string. In botany, the thread which attaches the seed to the carpel or placenta.

UMBILICUS. The navel.

UNCIFORM BONE. One of the bones of the wrist.

UNCONFORMABLE STRATA. Strata which do not incline or dip in the same direction as those below or above them.

UNDERWOOD. Coppice, small trees, or shoots from old stools.

UNGUIS. The claw or small extremity of a petal, where it is inserted into the stem.

UNGULATES. Those quadrupeds furnished with a hoof.

UNILOCULAR. Seed vessels which contain but one cavity.

UPAS. A Javanese tree, from which the upas poison is secreted; the *Antiaris toxicaria.*

UPONG. *Ilex vomitoria* and *cassina.* The black drink, medicine, or tea plant of North Carolina, used by the Indians.

UREA. A peculiar crystallizable substance held in solution in the urine. When dried in vacuo it consists, according to Dr. Prout, of,

	Atoms.	Experiment.
Nitrogen	2	46·65
Carbon	2	20·07
Hydrogen	1	6·65
Oxygen	4	26·63
	1	100·00

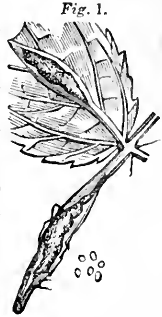
Urea is readily soluble in water, tasteless, inodorous; and when mixed with the other contents of the urine, very prone to putrefaction, the principal result of which is carbonate of ammonia.

UREDO. "As the diseases of corn occasioned by fungi belonging to the genus *Uredo* are of great importance, we shall describe them particularly. In the article *Burned Ear*, a diseased state of wheat is described, in which the *Uredo segetum* appears.

"*Uredo caries*, De Candolle (*U. fœtida*, Bauer), is found on wheat; the sporidia are included within the ovary of the fruit, and are exactly spherical, rather large, globose, and black. When this plant appears on wheat it is said to have the bunt, smut-balls, or pepper-brand. The sporidia may be detected in the young seed in the very earliest states of the flower-bud, and when perfectly ripe it occupies the whole interior of the grain, but does not burst the skin, so that the grain retains the character of being perfectly sound. The sporidia are frequently mixed with delicate fibres, which seem to constitute the mycelia of the plant. Henslow calculates that a single grain of wheat may contain more than 4,000,000 of sporidia. Each of these sporidia probably contains millions of sporules; hence some idea may be formed of their minuteness, as well as their capacity for spreading themselves in every direction. Another peculiarity of this fungus is, that it has a very disgusting smell, and the consequence is that flour made from grains containing it cannot be eaten. Flour thus spoiled is, however, sold to gingerbread-makers, who have found out that mixing it with treacle conceals its disagreeable odour. It does not appear to act injuriously when taken. In raising wheat for seed, the greatest care should be taken that none affected with the smut fungus is used, as it seems proved that where the sporules of the fungus are present in the seed sown, they will grow up with the plant, and be developed at the period of its ripening the fruit. Many remedies have been proposed for getting rid of the sporules from wheat about to be sown. Washing with clean water has been found effectual, and with lime-water much more so, but of all applications a solution of sulphate of copper (blue vitriol) seems to answer best. The following is a good instance of the effect of dressing wheat: 'Mr. John Woolnough, of Boyton, sowed a large field in alternate breadths with wheat taken from a good sample without dressing, and wheat that had been dressed. Long before the grain was ripe the difference was most distinguishable. Upon those stretches sown with dressed wheat it was difficult to find any branded ears, while the others were so branded as to make him determine to carry the wheat at separate times to different places.'"—(*Linn. Trans.*, vol. v.)

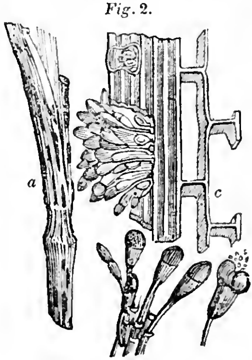
The common character of the fungi of this class is their production within the plant, through the skin of which they often break, as in the *Uredo diffusa*, that attacks fruit-trees (*Fig.* 1).

Fig. 1.



"*Uredo rubigo* and *linearis* form yellow and brown oval spots, and blotches of an orange and yellow colour upon the stem, leaf, and chaff of grain, and various grasses. The sporidia of *U. linearis* are more oblong than those of *U. rubigo*, but they are frequently found together. When these plants are present the disease of the grain is called rust, red rag, red robin, and red gum. This is the plant which Henslow believes to be identical with the *Puccinia graminis*, which occurs in wheat affected with mildew." *Figure* 2 represents the

Fig. 2.



Puccinia graminis, or rust: it is of the natural size in the stem, *a*, magnified in *b*, and the stem also magnified in *c*. "The mildew and the rust are often confounded together by farmers, and, as shown by Henslow, there is no difference in the essential character of the plant which is the offspring of the disease. Rust and mildew are not so certainly prevented as smut, although there is reason to believe that the sporules of the *U. rubigo* are taken less up by the roots, in the same manner as those producing smut. As a dressing, the use of the lime-water or sulphate of copper should never be neglected; although it may not always prevent rust, yet there are instances recorded in which undressed wheat has had rust, when dressed wheat from the same sample has not had it.

"Connected with the question of blight in corn is one that has produced much discussion, and that is, how far the barberry (*Berberis vulgaris*) is the cause of it. There is a very general impression among farmers that the barberry-bush produces rust in corn, and there are numerous well-authenticated instances of blight occurring in the vicinity of barberry-bushes and hedges. Botanists, not seeing how this could occur, have generally treated the fact as a coincidence, and acquitted the barberry altogether of the crime of producing blight; but the evidence of blight occurring as the consequence of the presence of the barberry is constantly increasing. One of the best explanations of this curious circumstance is, that the barberry itself is subject to the attacks of a fungus, the *Æcidium berberidis*, similar to that which produces the disease in wheat. The specific characters of the two, however, are very different, and it is only by having recourse to the supposition that many of the recorded species of *Æcidium* are merely varieties changed in character by change of position, that such an explanation of the fact can be admitted.

"Besides the species of uredo mentioned, corn and all other plants are subject to the attacks of a large number of these fungi. On whatever plant they are found they are indicative of disease, and the produce of the plant will not be so great as when in a state of health. Sir H. Davy found that 1000 parts of good wheat yield, on an average, 955 parts of nutritious matter, while specimens from mildewed wheat yielded only from 650 to 210 parts in the same quantity." See, also, *Mildew*.

URETERS. The tubes which convey urine from the kidneys to the bladder.

URETHRA. The passage from the bladder outward, for the discharge of urine.

URIC ACID, LITHIC ACID. An acid occurring in large quantity, combined with ammonia, in the urine of birds and reptiles, and to a small extent only in the urine of carnivorous quadrupeds. In the pure state it is a very insoluble white powder; it dissolves in nitric acid, and when evaporated to dryness and mixed with a little ammonia, gives the rich red colour of murexide. The composition of uric acid is $C_{10}\,H_4\,N_4\,O_6$: it is converted by putrefaction into bicarbonate of ammonia. Peruvian guano contains eight to twenty per cent. of this acid, but the African is usually without it.

URINE. The fluid excrement of quadrupeds: in birds and reptiles it is solid. The urine contains the greatest portion of the nitrogenized matters of the excrements, and is therefore the most important portion of manure. The composition of human urine is given in the article *Night Soil*, the management of that of the cow under the article *Flanders Husbandry*.

"The efficacy of urine as a manure depends upon the quantity of solid matter which it holds in solution,

Urine of	Water in 1000 parts.	Solid matter in 1000 parts.			Aver. quantity voided in 24 hours.
		Organic.	Inorganic.	Total.	
Man	969	23·4	7·6	31	3 lbs.
Horse	940	27	33	60	3 "
Cow	930	50	20	70	40* "
Pig	926	56	18	74	?
Sheep	960	28	12	40	?

* Not in milk. When in milk, about half of this.

upon the nature of this solid matter, and especially upon the rapid changes which the organic part of it is known to undergo. The preceding table exhibits the average proportions of water, and of the solid organic and inorganic matters contained in the urine of man and some other animals in their healthy state, and the average quantity voided by each in a day.

"The numbers in the above table show that the urine of the cow, estimated by the quantity of solid matter it contains, is more valuable than that of any other of our domestic animals, with the exception of the pig. But the quantity voided by the cow must be so much greater than by the pig, that in annual value the urine of one cow must greatly exceed that of many pigs.

"It might be supposed at first that in all animals the quantity of urine voided would have a close connexion with the quantity of water which each was in the habit of drinking. But this is by no means the case. Thus it is the result of experiment, that in man the drink exceeds the urine voided by *about one tenth part only*, while a horse, which drank 35 lbs. of water in 24 hours, gave only 3 lbs. of urine during the same time; and a cow, which drank 132 lbs. of water, gave 18 lbs. of urine and 19 lbs. of milk.—(*Boussingault.*)

"How very large a quantity of the liquid they drink must escape from the horse and the cow in the form of insensible perspiration! That this should be very much greater indeed than in man, we are prepared to expect from the greater extent of surface which the bodies of these animals present.

"Let us now examine more closely the composition of urine, the changes which by decomposition it readily undergoes, and the effect of these changes upon its value as a manure.

"*Human Urine.*—The exact composition of the urine of a healthy individual, examined in its usual state, was found by Berzelius to be as follows:

Water	933·0
Urea	30·1
Uric acid	1·0
Free lactic acid, lactate of ammonia, and animal matter not separable	17·1
Mucus of the bladder	0·3
Sulphate of potash	3·7
Sulphate of soda	3·2
Phosphate of soda	2·9
Phosphate of ammonia	1·6
Common salt	4.5
Sal-ammoniac	1·5
Phosphates of lime and magnesia, with a trace of silica and of fluoride of calcium	1·1
	1000·0

"From what I have already had occasion to state in regard to the action upon living plants, of the several sulphates, phosphates, and other saline compounds mentioned in the above analysis, you will see that the fertilizing action of urine would be considerable, did it contain no other solid constituents. But it is to the urea which exists in it in very much larger quantity than any other substance, that its immediate and marked action in promoting vegetation is chiefly to be ascribed. This urea, which is a white, salt-like substance, consists of,

	per cent.
Carbon	20·0
Hydrogen	6·6
Nitrogen	46·7
Oxygen	26·7
	100·0

"It is, therefore, far richer in nitrogen than all other richly-fertilizing substances.

"But urea possesses this farther remarkable property, that when urine begins to ferment, it changes entirely into carbonate of ammonia. Of the ammonia thus formed, a portion soon begins to escape into the air, and hence the strong ammoniacal odour of fermenting urine. This escape of ammonia continues for a long period, the liquid becoming weaker and weaker, and consequently less valuable as a manure every day that passes. Experience has shown that recent urine exercises in general an unfavourable action upon growing plants, and that it acts most beneficially after fermentation has freely begun, but the longer time we suffer to elapse after it has reached the *ripe* state, the greater the quantity of valuable manure we permit to go to waste.

"*The urine of the cow* has been analyzed in several states by Sprengel, with the following results in 1000 parts:

	Fresh.	Allowed to ferment for four weeks in the open air. A.	B.
Water	926·2	954·4	934·8
Urea	40·0	10·0	6·0
Mucus	2·0	0·4	0·3
Hippuric and lactic acids	6·1	7·5	6·2
Carbonic acid	2·6	1·7	15·3
Ammonia	2·1	4·9	16·2
Potash	6·6	6·6	6·6
Soda	5·5	5·5	5·6
Sulphuric acid	4·0	3·9	3·3
Phosphoric acid	0·7	0·3	1·5
Chlorine	2·7	2·7	2·7
Lime	0·6	trace	trace
Magnesia	0·4	0·2	0·4
Alumina, oxide of iron, and oxide of manganese	0·1	trace	—
Silica	0·4	0·1	0·1
	1000·0	998·2	999·0

"The first variety of fermented urine (A.) had stood four weeks in the air in its natural state of dilution; the second (B.) had been mixed while recent with an equal bulk of water—which is again deducted from it in the analysis—with the view of ascertaining how far such an admixture would tend to retain the volatile ammonia produced by the natural decomposition of the urea.

"An inspection of these tables shows three facts of importance to the agriculturist:

1°. That the quantity of urea in the urine of the cow is considerably greater than in that of man. 2°. That as the urine ferments the quantity of urea diminishes, while that of ammonia increases; and, 3°. That by dilution with an equal bulk of water the loss of this carbonate of ammonia. which would otherwise naturally take place, is in a considerable degree prevented. *The quantity of ammonia retained by the urine, after dilution, was in the same circumstances nearly three times as great as when it was allowed to ferment in the state in which it came from the cow.*

"But even by this dilution the whole of the ammonia is not saved. This shows the necessity of causing our liquid manures to ferment in covered cisterns, or of adopting some other means by which the above serious loss of the most valuable constituents may be prevented.

"*The urine of the horse, sheep, and pig* have not been so carefully analyzed as that of the cow. They consist essentially of the same constituents, and the specimens which have been examined were found to contain the three most important of these in the following proportions:

	Horse.	Sheep.	Pig.
Water	940	960	926
Urea	7 ?	28	56
Saline substances	53	12	18
	1000	1000	1000

"Some of the saline substances present in the urine, as above stated, contain nitrogen. This is especially the case in the urine of the horse, so that the quantity of urea above given is not to be considered as representing the true ammonia-producing power of the urine of this animal. The urine of the pig, if the above analysis is to be relied upon as anything like an average result, is capable of producing more ammonia from the same quantity than that of any other of our domestic animals.

"*Of the Waste of Liquid Manure—of Urate, and of Sulphated Urine. Waste of Human Urine.*—The quantity of solid matter contained in the *recent* urine voided in a year by a man, a horse, and a cow, and the weight of ammonia they are respectively capable of yielding, may be represented as follows:

	Quantity of urine.	Solid matter.	Containing of urea.	And yielding of ammonia.
Man	1,000 lbs.	67 lbs.	30 lbs.	17 lbs.
Horse	1,000	60	?	?
Cow	13,000	900	400	230

"How much of all this enriching matter is permitted to run to waste! The solid substances contained in urine, if all added to the land, would be more fertilizing than guano. If we estimate the urine of each individual on an average at only 600 lbs., then there are carried into the common sewers of a city of 15,000 inhabitants a yearly weight of 600,000 pounds, or 270 tons of manure, which would, no doubt, prove more fertilizing than its own weight of guano, and might be expected to raise an increased produce of not less than 8000 bushels of grain.

"The saving of all this manure would be a great national benefit, though it is not easy to see by what means it could be effectually accomplished. What is thus carried off by the sewers, and conveyed ultimately to the sea, is drawn from and lost by the land, which must, therefore, to a certain extent, be impoverished. Can we believe that in the form of fish, of sea-tangle, or of spray, the sea ever delivers back a tithe of the enriching matter it daily receives from the land!

"*Urate.*—In order to prevent a portion of this waste, the practice has been introduced into some large cities of collecting the urine, adding to it one seventh of its weight of powdered gypsum, allowing the whole to stand for some days, pouring off the liquid, and drying the powder. Under the name of *urate* this dry powder has been highly extolled, but it can contain only a small portion of what is really valuable in urine. The liquid portion poured off must contain most of the soluble ammoniacal and other salts, and even were the whole evaporated to dryness, the gypsum does not act so rapidly in fixing the ammonia as to prevent a considerable escape of this compound as the fermentation of the urine proceeds.

"*Sulphated Urine.*—A method of more apparent promise is that now practised by the Messrs. Turnbull of Glasgow, of adding diluted sulphuric acid to the urine as the ammonia is formed in it, and subsequently evaporating the whole to dryness. From the use of this substance very favourable results may be anticipated. Still none of these preparations will ever equal the urine itself, part of the efficacy of which depends upon the perfect state of solution in which all the substances it contains exist, and upon the readiness with which in this state they make their way into the roots of plants.

"*Loss of Cows' Urine.*—When left to ferment for five or six weeks alone, and with the addition of an equal bulk of water, the urine of the cow loses, as we have seen, a considerable proportion of volatile matter, and in these several states will yield in a year,

	Solid matter.	Yielding of ammonia.
Recent urine	900 lbs.	226 lbs.
Mixed with water, after six weeks . . .	850 "	200 "
Unmixed, after 6 weeks.	550 "	30 "

"Those who scrupulously collect in tanks, and preserve the liquid manure of their stables, cow-houses, and fold-yards, will see, from the great loss which it undergoes by natural fermentation, the propriety of occasionally washing out their cow-houses with water, and by thus diluting the liquid of their tanks, of preserving the immediately operating constituents of their liquid manure from escaping into the air. Even when thus diluted it is desirable to convey it on to the land without much loss of time, since even in this state there is a constant slow escape, by which its value is daily diminished. Gypsum, sulphate of iron, and sulphuric acid are, by some, added for the purpose of *fixing* the ammonia, but in addition to diluting it, an admixture of rich vegetable soil, and especially of peat, will be much more economical, and, except in so far as the gypsum and sulphuric acid themselves act as manures, nearly as effectual."

URN. The small receptacle of mosses in which the sporules are placed.

UROCERATA. The name of a tribe of the *Terebrantia*, or boring hymenopterous insects, in which the *ter-*

ebra, or borer, of the females is sometimes very long and prominent, and composed of three filamentary processes, sometimes capillary, and coiled in a spiral form in the interior of the abdomen.

USTILAGO. A name given to certain fungi which produce the appearance of burning on the leaves of plants; fire blight. This term was formerly applied to the *burned ear*, a disease of grain.

UTERUS. The womb.

UTRICLE, UTRICULUS. A one-celled, one or four seeded, superior membranous fruit, often bursting by a transverse suture. A little bladder.

UVA URSI. *Arbutus uva ursi.* Bear's berry. A small shrub, the leaves of which are used in medicine.

UVULA. The pendulous portion of the soft palate which hangs over the cavity of the pharynx.

V.

VACUUM. A void space. The cavity of any vessel from which air has been extracted by the air-pump is called a vacuum. A *Torricellian vacuum* is that above the mercury of a barometer.

VAGINA. A sheath: the passage from the uterus outward.

VALERIAN. *Valeriana officinalis.* A perennial herb, the root of which is a nervous stimulant.

VALLESNERIA. A genus of water weeds.

VALVE. In mechanics and zoology, a flap or small door opening only in one direction, and serving to close a tube or passage. There are many kinds of valves, as the door valve, the sliding valve. In botany, the pieces into which dry fruits or anthers burst naturally, are called valves.

VANILLA. The succulent fruit of the *Epidendron vanilla*, an orchideous climbing shrub of Mexico and tropical America. The seeds have a delightful aroma, and are used in flavouring confectionery and chocolate.

VAPOUR. The temporary gaseous condition of fluids.

VEERING. A ridge made in ploughing where two lands meet.

VEGETABLE CHEMISTRY. The chemical examination of all products of the vegetable world, as well as the functions of plants.

VEGETABLE OYSTER. See *Salsify*.

VEGETABLE PHYSIOLOGY. An examination of the growth and functions of plants.

VEIL. Calyptra. A membrane connecting the pileus with the stem of some mushrooms.

VEINS. The vessels which convey blood that has circulated through the body back to the heart.

VENA CAVA. The great veins which discharge the venous blood into the right auricle of the heart.

VENTER. In entomology, the lower part of the abdomen.

VENTILATION. The establishment of a current of air through any room or place.

VENTRICLE. A cavity of the heart, brain, &c.

VENTRICOSE. Any part which appears blown out.

VERATRIA. An active alkaloid principle, from the *Veratrum album*, or white hellebore.

VERBENA. The vervain (*Verbena teucrioides*), a shrubby plant, with leaves of a delightful lemon odour, and which are distilled for perfumery. It is propagated by slips.

VERJUICE. The juice of green grapes or apples, from which a vinegar is made.

VERMIN. Destructive animals or insects.

VERNATION. The manner in which the leaflets of a bud are folded.

VERRUCOSE. Having a wart-like appearance.

VERTEBRÆ. The bones of the spine, which is also called the vertebral column.

VERTEBRATES, VERTEBRATA. All animals having a spinal column.

VERTICAL. Upright, pointing to the vertex, or uppermost point overhead.

VERTICELLUS. A whorl. *Verticellate* is a derivative; disposed in a whorl.

VERTIGO. Giddiness.

VESICANTS. Substances which produce blistering.

VESICLE. A small bladder.

VESPIDÆ. The family of wasps.

VESTIBULE. A porch or anteroom.

VETCH. The genus *Vicia*, several of which bear pretty leguminous flowers. The *V. sativa* is the common tare.

VETCHLING. The genus *Lathyrus*, leguminous plants, frequently of great beauty, as the *L. latifolius*, or sweet pea.

VEXILLUM. The standard: the upper petal of a papilionaceous or pealike flower.

VIBRISSA. The pointed bristles which grow from the upper lip of animals, or from the jaws of birds, and are used as feelers.

VILLOSE. Woolly, covered with soft, flexible hairs closely set.

VILLOUS. Having the appearance of the pile of velvet.

VINE. *Vitis vinifera*, the Syrian vine, from which the numerous European varieties are produced; but in the United States there are indigenous the *V. labrusca*, or fox grape, of which the Isabella, Catawba, and Alexander grapes are supposed to be hybrids; the *V. æstivalis*, or little summer grape; *V. riparia*, the odoriferous grape. In the South there are also the bullet grape, *V. rotundifolia*, and the *V. palmata*.

Varieties. — The kinds of vines more or less cultivated in the United States are very numerous, and are divisible into two classes, foreign and domestic grapes.

Of the foreign kinds, most are cultivated for the table, and, according to the evidence of many speculators in the North, cannot be profitably cultivated north of Maryland except under glass, every effort to acclimate them in vineyards having failed, and few vines succeeding except in warm, sheltered spots, or in cities. These kinds are, however, of such remarkable excellence, and so superior to the native varieties, that they are obtained wherever the means of cultivation exist. The best are the black Hamburgh, black Muscadine, Miller's Burgundy, black, grizzly, and white Frontignan, royal Muscadine (*Chasselas*), early white Muscadine, white sweetwater (*white Chasselas*), Muscat of Alexandria, white and red Malaga, white St. Peter, and white Tokay. Of these, the sweetwater is acclimated in Virginia and South, and the black Hamburgh will stand the open air in Pennsylvania.

Of the American grapes, the Alexander (Vevay, Madeira of York), the Catawba, Cunningham, Elsinburgh, Norton's Virginia, black Scuppernong, and Warren's Madeira, are best: most of them are, however, southern, the Isabella, Catawba, Alexander, and Elsinburgh growing north of Pennsylvania. Of these, the Scuppernong is used for wine in North Carolina. The Catawba and Cunningham also yield good wine in Virginia; the Alexander (or Vevay) and Warren's Madeira are cultivated in Pennsylvania and Ohio for wine. Several seedlings are also of good repute from Ohio; but, on the whole, the Scuppernong and Catawba appear to be in the highest esteem of all native grapes for wine.

Training.—The favourite method of training vines which require no wall is along espaliers; but in North Carolina they are carried over flat arbours, rising eight to twelve feet above the ground. The short bush method of pruning, by which the plant is stunted to a small bush of three or four feet, is common in some parts of France. In Italy they are allowed to grow over mulberry trees. Mr. Hoare's treatise is the text-book of the vine cultivator; we therefore abstract the following, which is the plan pursued by the principal dressers in New-York and Pennsylvania:

"*Aspect.*—The warmer the aspect, the greater perfection does the grape attain in the North, provided all other circumstances are alike; and if the greatest quantity of the sun's rays shining on the surface of a wall were alone to be considered as constituting the best aspect, there would, of course, be no difficulty in naming a due southern one as better than any other. But *warmth* alone is not sufficient; *shelter* from the wind is equally necessary. The best aspects are those that range from the eastern to the southeastern, both inclusive. The next best are those from southeast to south; but this depends somewhat on local peculiarities.

"*Soil.*—The natural soil which is most congenial to the growth of the vine, and to the perfection of its fruit in this country, is a light, porous, rich, sandy loam, not more than 18 inches in depth, on a dry bottom of gravel, stones, or rocks. A strong argillaceous soil is injurious to the vine; it checks the expansion of the roots, and retains too much moisture. In calcareous soils the vine always flourishes, especially if the bottom be stony or gravelly. No subsoil can possess too great a quantity of these materials for the roots of the vine, which run with eagerness into all the clefts, crevices, and openings in which such subsoils abound. In these dry and warm situations, the fibrous extremities, pushing themselves with the greatest avidity, and continually branching out in every possible direction, lie secure from that excess of moisture which frequently accumulates in more compact soils; and, clinging like ivy round the porous surfaces of their retreats, extract therefrom a species of food more nourishing than that obtained by them under any other circumstances whatever. All borders, therefore, made expressly for the reception of vines ought to be composed of a sufficient quantity of dry materials, such as stones and brickbats, broken moderately small, lumps of old mortar, broken pottery, oyster shells, &c., to enable the roots to extend themselves freely in their search after food and nourishment; to keep them dry and warm by the free admission of air and solar heat, and to admit of heavy rains passing quickly through, without being retained sufficiently long to saturate the roots, and thereby injure their tender extremities. The sweepings obtained from a turnpike road, or from any other high road kept in a good state of repair by the frequent addition of stones, and on which there is a considerable traffic of horses or other cattle, is the very best compost that can be added to any border intended for the reception of vines. Its component parts, consisting chiefly of sand, gravel, pulverized stones, and the residuum of dung and urine, afford a greater quantity of food, and of a richer and more lasting nature, than can be found in any other description of compost that I have ever seen or heard of being used for that purpose. Borders in which vines are planted should never be cropped nor digged.

"*Manure.*—The best species of manure for the vine are those which afford a considerable degree of nourishment, but at the same time slowly decompose in the soil. Such are bones, whole or crushed, the horns and hoofs of cattle, the entire carcasses of animals, cuttings of leather, woollen rags, feathers, and hair, and the leaves of the vines themselves. Liquid manures are also valuable, and forcing in their effect; of this class the most powerful are urine, soot water, blood, the drainings of dung heaps, and soap suds. It should, however, always be recollected that the more manure is used the poorer the wine procured from the grapes. As a top-dressing, and to be forked into the border, nightsoil, refuse fish, stable manure, and the excrements of all birds and animals, will be found highly enriching substances as fertilizers, and their nutritive and stimulating properties have been frequently alluded to in the progress of this work; but if rich manures are used, they should be mixed with turf and sand. In the Alto Douro is a law which prohibits the vine being 'littered,' as this operation, though it considerably augments the produce, tends to deteriorate the quality of the wine.

"*On the Construction of Walls.*—No general rule can be laid down as to the height of the wall, which must necessarily vary under different situations and circumstances. Mr. Hoare states that in unsheltered situations and exposed aspects he has never seen fine grapes produced much higher than eight feet from the ground; but in favourable situations height is of no consequence. If built for the express purpose of rearing grapes, low walls of not more than six feet are to be preferred, as more convenient for pruning and training the vines. Brick walls are undoubtedly the best, the surface being smooth and even. A considerable heat is obtained by blackening the walls.

" *Propagation.*—Vines are propagated in the open ground by layers and by cuttings. The former is the most expeditious mode, provided the shoots be laid down in pots and planted out the same summer. The latter mode is much the best. To provide cuttings to be planted at the proper season, select, at the autumnal pruning, a sufficient number of shoots of the preceding summer's growth. Choose such as are well ripened, of a medium size, and moderately short jointed. Cut them into convenient lengths of six or eight buds each, leaving at the ends not less than a couple of inches of the blank wood for the protection of the terminal buds. Stick these temporary cuttings about nine inches in the ground, in a warm and sheltered situation, where they will be effectually protected from the severity of the winter. The best time to plant them out is about the middle of March, but any time from the 1st of that month to the 10th of April will do very well.

" *Pruning and training* are so closely connected together, and so mutually dependant on each other, that they almost constitute one operation. The judicious pruning of a vine is one of the most important points of culture throughout the whole routine of its management. The object is to get rid of all the useless and superabundant wood; for those shoots of a vine which bear fruit one year never bear any afterward. There are three methods of pruning vines in practice among gardeners, namely, the long pruning, spur pruning, and the fan or fruit-tree method. The first is considered to be the most eligible meth od, and is that which is practised and recommended by Mr. Hoare. As the sole object in view in pruning a vine is to increase its fertility, the best method to accomplish this is to leave a sufficient supply of bearing shoots on the least possible proportionate quantity of old wood.

" Long pruning appears to recommend itself by its simplicity; by the old wood of the vine being annually got rid of; by the small number of wounds inflicted in the pruning; by the clean and handsome appearance of the vine; and by the great ease with which it is managed, in consequence of its occupying but a small portion of the surface of the wall.

" 1st. In pruning, always cut upward, and in a sloping direction.

" 2d. Always leave an inch of blank wood beyond the terminal bud, and let the cut be on the opposite side of the bud.

" 3d. Prune so as to leave as few wounds as possible, and let the surface of every cut be perfectly smooth.

" 4th. In cutting out an old branch, prune it even with the parent limb, that the wound may quickly heal.

" 5th. Prune so as to obtain the quantity of fruit desired on the smallest number of shoots possibie.

" 6th. Never prune in frosty weather, nor when a frost is expected.

" 7th. Never prune in the months of March, April, or May. Pruning in either of these months causes bleeding, and occasions thereby a wasteful and an injurious expenditure of sap.

" 8th. Let the general autumnal pruning take place as soon after the 1st of October as the gathering of the fruit will permit.

" Lastly, use a pruning knife of the best description, and let it be, if possible, as sharp as a razor.

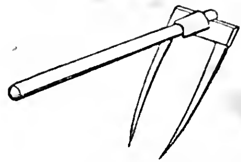
" *Training.*—To train a vine on the surface of a wall is to regulate the position of its branches, the principal objects of which are, to protect them from the influence of the wind; to bring them into close contact with the wall, for the purpose of receiving the benefit of its warmth; to spread them at proper distances from each other, that the foliage and fruit may receive the full effect of the sun's rays, and to retard the motion of the sap, for the purpose of inducing the formation of fruit buds. The flow of sap, it must be remembered, is always strongest in a vertical direction, and weakest in a downward one. For this reason, the method of serpentine training may be considered preferable to every other, being calculated in a greater degree to check the too rapid ascent of the sap, and to make it flow more equally into the fruiting shoots, and those intended for future bearers. On walls that are much less than five feet high, a portion of the shoots must be trained horizontally."

In respect to the making of *wine* much is to be learned; it seems that, in order to preserve it, an addition of sugar, brandy, or spirits is universally made; this is not, however, making wine in the proper sense of the word. I am informed by the largest wine maker in North Carolina, that one fourth part brandy or spirits is added to each gallon of scuppernong wine, or that two pounds of sugar are fermented with a gallon of the must. Mr. Weller, of North Carolina, breaks his grapes by passing them between rollers, and then strains the juice through flannel, to deprive it of a portion of the extraneous matters. General Van Ness, of Washington, produced a wine resembling hock, by mixing equal parts of Isabella and Catawba grapes, and adding 1 lb. 7 ounces of fine unrefined sugar to each gallon of must; but no spirits to the wine. The following particulars of the culture and management of grapes are from Mr. Rham and M. Boussingault:

"It may, however, be interesting to know how the vine is cultivated in the countries which produce good wine, of which France is one of the principal. The vine grows best in a soil where few other shrubs or plants would thrive. The vine delights in a deep, loose, rocky soil, where its roots can penetrate deep into fissures, so as to ensure a supply of moisture when the surface is scorched by the sun's rays. On the deep slopes of hills towards the south, and sheltered from the northeast, the grapes attain the greatest maturity, and the vintage is most certain. So great an influence has a favourable exposure, that in the same vineyard the greatest difference exists between the wine made from one part and that made from another, merely because there is a turn round the hill, and the aspect varies a very few degrees. A change of soil produces a similar effect. The famous Rhine wine called Johannisberg, when made from the grapes which grow near the castle, is worth twice as much as that made a few hundred yards farther off. Here both soil and aspect change. The *Clos de Vougeau*, which produces the finest Burgundy, is confined to a few acres; beyond a certain wall the wine is a common Burgundy, good, but without extraordinary merit.

"The best vineyards in Europe formerly belonged to monasteries, and the quality was then thought of more importance than the quantity; of late the demands of commerce have made the quantity the principal object, and to this the quality is frequently sacrificed.

"When a vine is first established on any spot where none grew before, the first thing is to prepare the ground for planting. In steep places, where the soil might be carried away by rains in winter or spring, terraces are formed by building massive stone walls along the slope, and levelling the soil behind them. The walls serve to reflect the heat, and form a shelter to the vine below. Thus a whole hill is sometimes covered with terraces from top to bottom, and there the wine is generally good, if the exposure is favourable. Limestone, gravel, or coarse sand, with a small mixture of clay, form a good soil for a vine; vegetable substances alone should be used to enrich it, such as the leaves and tendrils of the vine, the residue of the grape when pressed, and, failing these, the leaves of trees collected when green, and formed into a compost with earth. The ground should be well trenched, if it will admit of it, or loosened with the mattock and pickaxe, as we should do a mass of gravel which was to be spread on a road, and which was too hard for the shovel or spade. The different parts of the soil should be intimately mixed, keeping some fine earth or soil at top to set the plants in. When the ground is prepared, holes are dug in rows four or five feet wide, at the same distance from each other, so as to alternate; some of the finest of the soil is put into each hole, and the vine plants which have been rooted in a nursery, or else simple cuttings, are carefully inserted, pressing the mould round the roots, and levelling the earth round them. Rooted plants will bear the second or third year, but cuttings take a much longer time. The season for planting is during the winter, when the weather is open. If cuttings are used, they are taken off the vine on which they grew at the usual time of pruning after the vintage; a piece of the preceding year's wood is left on the cutting, and when it is planted, the end where the old wood is left is bent or twisted to facilitate its striking: three or four eyes are buried, so that the end is at least a foot underground. If the plant is already rooted, care is taken not to wound or bend the roots, but to spread them out and cover them with mould. During all the time that the vine is growing, the ground must be regularly cultivated and kept perfectly clear of all weeds. The usual instrument of tillage in stony and rocky soils is a two-pronged fork fixed in a short handle, at an angle less than a right angle with the prongs, which are a foot long and very strong, like a double pickaxe (see *Fig.*). This is struck into the ground and then drawn towards the workman, while



the handle is lifted, which acts as a lever in raising the soil. The roots are by this means enabled to spread through the soil in search of moisture and food. The next year it is usual to prune the young vine down to one, or, at most, two eyes or buds; but some experienced vine dressers recommend deferring this operation to the second year, by which, although the vine will not be so forward in fruiting, it will be much strengthened, and fully repay the apparent loss of time in the end.

"In the third year the vine is trained, that is, the shoots are tied to upright stakes planted at each root, or they are laid in an arch and tied from one root to another along the ground. In southern climates trees are planted at a certain distance from each other, and the vine, planted at their foot, is allowed to run up their branches, from which it is led in festoons from tree to tree, while the head and branches of the tree are cut off to prevent too much shade. This is by far the most elegant mode of training the vine; but in France the stakes and the low training are the only methods suitable to the climate. The pruning is generally done in the beginning of winter.

"When vineyards are established in the plains, where sometimes, as those of Medoc, they produce very good wine, the intervals between the plants can be stirred by the plough, although forking and digging by hand is more common; hoeing is as necessary in a vineyard to destroy weeds as it is in a field of turnips or any other crop sown in rows. Wherever a vineyard is overrun with weeds, you may be sure that there is no good wine, and much poverty in the proprietor. The pruning of a vine in bearing, the object of which is to produce much fruit without weakening the plant, can only be learned by experience and practice; much of the success of a vineyard depends on this operation. In the best vineyards no manure is used except that which we mentioned before, of leaves and tendrils; but some soils require to be recruited, and without manure would produce little or no wine. In this case there is no alternative, and composts must be formed, as is done in common cultivation, with animal and vegetable substances mixed and decomposed. Horse dung should be avoided, if possible; cow dung is cooler and more nearly of a vegetable nature; this should be mixed with as much virgin earth from pastures and meadows as can be procured, and laid in small heaps in the intervals between the rows. It may be left a little while if it has any rank smell, and then forked in round the roots; the more it is decomposed the better. Many a vineyard has lost its reputation after having been abundantly manured. The Johannisberg was much reduced in value after having been dunged, while in the possession of General Kellerman, and it has not yet regained all its former reputation.

"After a certain time, which differs in different situations, the vine becomes less productive from the exhaustion of the soil, as is the case when the same crops are repeatedly sown in the same ground: this depends on the depth of the soil. All perennial plants shoot out their roots farther and farther every year in search of fresh earth, and it is by this means that trees flourish for a long time on the same spot; but if the roots are prevented from spreading, or, the plants being too crowded, their roots interfere, a diminution of vigour is the consequence. So it is with the vine. In some situations, where the roots strike in crevices of rocks in which rich earth is accumulated, the vines will continue in vigour for many years; but where their progress is arrested by a solid rock or substratum, they will, in time, show signs of exhaustion. In this case the remedy is the same as for land bearing corn. A fallow, or rest, as it is usually called, is necessary, together with the addition of such manures as shall restore the lost fertility. For this purpose, a portion of the oldest roots are dug up every year, and the ground trenched or loosened two feet deep or more with the mattock, to expose it to the influence of the atmosphere. A compost is prepared with sods taken from pastures, or any virgin earth which can be procured; this is mixed with some lime and turned over several times, to rot all the roots and grass which may be in it, and to make it a uniform and rich mould. Holes are now made, exactly as when a new vine is planted, and in each of them a basket or barrowful of earth is thrown; in this the new plants or cuttings are planted to produce new vines in due time: thus the vineyard is gradually renovated. The proportion thus fallowed every year depends on the natural duration of the vine in that particular situation. In inferior soils one seventh is thus renewed every year; in some a twentieth part is sufficient; and there are vineyards which have never been renewed in the memory of the present generation, but these are few in proportion to the rest."

"Grape juice contains, 1st, grape sugar; 2d, albumen and gluten; 3d, pectine; 4th, a gummy matter; 5th, a colouring matter; 6th, tannin; 7th, bitartrate of potash; 8th, a fragrant volatile oil, cream of tartar; 9th, water. It is obvious, therefore, that grape juice contains within itself the elements necessary for the production of the vinous fermentation. The relative proportions of these different elements, however, are singularly modified, according to the nature of the vine, the quality of the soil, and especially the heat of the climate. The limits to the culture of the vine in Europe are generally fixed where the mean temperature is from 50° to 52° Fahr. Under a colder climate no drinkable wine is produced. To this meteorological datum must be added the farther fact that the mean heat of the cycle of vegetation of the vine must be at least 59° Fahr., and that of the summer from 65° to 67° Fahr.

"As the quality of wine depends mainly on the ripeness of the grapes, the vintage does not take place until this is complete, or until there is no longer any prospect of improvement.

"The must of the grape is procured by treading and pressing the fruit; the juice is run into vats, and the fermentation takes place in cellars: different procedures, however, are followed in different places. The fermentation having subsided in the larger vessels, the wine is drawn off into smaller casks, which are carefully filled up from time to time, and in which it is preserved.

"Wine may be defective, especially by wanting strength and being too acid. Sharp wine contains an excess of cream of tartar and free vegetable acids, and is always the produce of grapes which have not been completely ripe. The deficiency of strength is due to the same cause, for it is well known that as the grape ripens, its acids disappear and are replaced by sugar. This deficiency of saccharine matter in the must is now habitually supplied by the addition of a quantity of artificial grape sugar, prepared from starch. In warm countries, where the grape always ripens, the quantity of tartar is small; the sugar then predominates greatly—sometimes to such an extent that the azotized substance of the must is insufficient as a ferment, and it is then that we have wines of too sweet a flavour, such as those of Lunel and of Frontignac. When these musts, which are so rich in sugar, contain the proper quantity of ferment, they produce very strong wines, in which, of course, the sweet flavour no longer predominates. Such are the dry wines of southern vineyards, of which that of Madeira may be taken as the type. There are some wines which participate at once in the properties that distinguish the two varieties that I have mentioned, or that show one of them in excess, according to circumstances; such are the wines of Xeres, Alicant, and Malaga. Some of these wines are what are called boiled wines, that is to say, a portion of the must, as it flows from the press, is concentrated to a fourth or a fifth of its original bulk by boiling; and this being added to the rest, the strength of the resulting wine is increased. Sometimes the concentration of the juice is effected by drying the grapes partially. It is in this way that the celebrated Hungarian wine, called Tokay, is prepared; the clusters are left upon the vines after they are ripe, and alternately exposed to the cold of the night, which probably decomposes, to a certain extent, the texture of the grapes, and to the heat of the sun. They shrivel and become partially dry. In this state the grapes are subjected to pressure, and a very sweet must, as may be conceived, flows from them. In less favourable climates, where the rains of autumn prevent the drying of the clusters upon the vine stocks, the same thing is effected by laying the bunches upon straw in open or well-aired granaries or sheds. It is with the must procured from grapes so treated, that the sweet and often strong wines, which are called *vins de paille*, are obtained. Wines, when stored in the cask, always deposite with time a copious sediment, the lees. This sediment, in which tartar predominates, appears to be the consequence of an increase in the proportion of alcohol in the liquor. The alcohol may increase from two causes: first, by the fermentation which, though nearly insensible, goes on in most wines so long as there is any sugar left unchanged; and next, from mere keeping. It is well known, in fact, that wine put into the best casks, and kept in a well-ventilated cellar, loses a very perceptible quantity by evaporation. It is found necessary to fill up the casks from time to time. The loss has taken place through the pores of the wood, in virtue of an attraction exerted between the substance of the wood and the included liquid; and as this attraction is much greater between the organic matter and water than between organic fibre and alcohol, it is easy to conceive how wine kept in wood should improve. The very same thing, in fact, appears to go on in regard to wine in corked bottles: the cork does not oppose all evaporation, and it seems probable that it is not merely upon some new and little known change of a chemical nature in the constitution of the wine that its improvement and mellowing in bottle depend, but also upon the loss of a certain quantity of its water through the pores of the cork.

"Throwing quality, flavour, &c., out of the question, it is well known that a vineyard, cultivated in the same way, year after year, receiving the same quantity of the same kind of manure, of which the vintage is managed in the same manner, the wine made by the same method, &c., yields a produce which differs greatly in regard to the quantity of alcohol it contains in different years. The vineyard of Schmalzberg, for example, near Lampertsloch, which has been under my management for several years, yields wines of the most dissimilar characters from one year to another. Some idea of this may be formed from the different quantities of alcohol which the wine of different years contains:

Years.	Mean temperature.						Wine per acre in gallons.	Pure alcohol per cent.	Pure alcohol per acre in gallons.
	Of the whole term of the growth of the vines.		Of the summer.		Of the beginning of autumn.				
	deg.	deg.	deg.	deg.	deg.	deg.			
1833	14·7C.	58·4F.	17·3C.	63·1F.	11·4C.	51·5F.	311	5·0	11·4
1834	17·3	63·1	20·3	68·½	17·0	63	314	11·2	46·3
1835	15·8	60·2	19·5	67	12·3	54	621	8·1	50·0
1836	15·8	60·2	21·5	71	12·2	54	544	7·1	38·6
1837	15·2	59 5	18·7	66	11·9	54	184	7·7	14·0

"If we now inquire how the meteorological circumstances of each of these five years influenced the production of our wine, we see at once that the mean temperature of the days which make up the period of the cultivation of the wine has a perceptible influence. The temperature of the summer was 63·1° of the year which yielded the strongest wine, and only 58·4° in 1833, the wine of which was scarcely drinkable.

"The produce of a vineyard also depends upon its age; and it would be curious to examine the progressive increase of the quantity of wine yielded. This information I am able to give in connexion with a vineyard established in Flanders. I only regret that I have no means of presenting parallel observations from a country more favourable to the vine. The vineyard of Schmalzberg was planted in 1822, with new cuttings from France, and from the borders of the Rhine. The vines are trained as espaliers, and are now rather more than four feet in height. The vineyard began to yield wine in 1825, and the following table shows the results in the successive years up to 1837:

Years.	Wine per acre in gallons.
1825	68·75
1826	192·0
1827	0·0
1828	115·0
1829	55·9
1830	0·0
1831	153·0
1832	209·9
1833	311·6
1834	413·4
1835	620·0
1836	544·5
1837	184·4

"The mean quantity of wine furnished by this vineyard from the date of its plantation is 224½ gallons per acre. M. Villeneuve reckons the mean produce of many vineyards in the southwest of France at from about 146 to 192 gallons per acre: considerably less, consequently, than our vineyard at Schmalzberg; and official documents, while they give the mean produce of the vine for the whole of France as 170·9 gallons per acre, state the whole of the wine produced over the country at 976,906,414 gallons."—(*Boussingault.*)

VINEGAR. "This term is applied to various modifications of the acetic acid. The simplest mode of obtaining vinegar is to excite a second or acetous fermentation in wine, beer, or cider. In this case oxygen is absorbed, a variable proportion of carbonic acid is generally evolved, and the alcohol of the wine passes into acetic acid. Very good vinegar is also made from a wort or infusion of malt prepared for the purpose, or from a decoction of common raisins, or from a mixture of about one part of whiskey with eight of water, and some sugar and yeast. See *Cider.*

"When vinegar is distilled, various impurities which it contains remain in the still, and the liquid which passes over is the acetic acid, nearly pure, but largely diluted with water. In this state it is usually called *distilled vinegar*, and is chiefly used in pharmacy; but the market is chiefly supplied from another source, which is the destructive distillation of wood. It has long been known that when certain kinds of dry wood, especially beech and such woods as are not resinous, instead of being burned in the open air, are converted into charcoal in close vessels, so as, in fact, to be submitted to distillation, that the vapours which pass off yield, when condensed, a large quantity of tar and of very acid water: the latter is, in fact, an impure vinegar. When this impure acetic acid is freed from the tar and empyreumatic oils with which it is mixed, it is called *crude pyroligneous acid.* To convert it into pure acetic acid, that is, to separate from it the empyreumatic products with which it is intimately combined, is a somewhat circuitous process. It is first distilled, by which *pyroxilic acid* and *oil of tar* first pass over, and these are followed by a quantity of impure or rough acetic acid. This rough acid is used by dyers and calico printers, and by makers of sugar of lead. The pure acetic acid, in its most concentrated state, is extremely acrid, sour, and pungent, and is often called *radical vinegar*, or, when perfumed, *aromatic vinegar;* it is also occasionally termed *glacial* acetic acid, from its property of congealing at a low temperature, and remaining frozen at temperatures below 50°. In this state it is a compound of 1 atom of real acetic acid = 51, and 1 of water = 9, the real or anhydrous acid, as it exists in the dry acetates, being composed of

Carbon	4
Hydrogen	3
Oxygen	3

"When this strong acetic acid is diluted with water and slightly coloured, it forms a very pure and excellent substitute for common vinegar, and is cheaper than acid of the same strength prepared in any other way.

"The combinations of acetic acid with various bases are called *acetates;* and of these salts some are importantly useful in the arts: such, especially, are the acetates of lead, copper, iron, and alumina, which are chiefly employed in dyeing and calico printing; the acetates of ammonia and of potash, which, as well as acetate of lead, are used in medicine; and the acetates of lime and of soda, which have been mentioned as steps in the preparation of strong acetic acid. The acetates are recognised by their solubility in water, and by the fumes of acetic acid which they evolve when acted upon by sulphuric acid. The specific gravity of the strongest liquid acetic acid is 10629; that of good malt vinegar is 10200; and that of distilled vinegar about 10023. The strength or value of vinegar, and of acetic acid, can only be learned by its saturating power."

VINEYARD. A plantation of grapes. The vines are set in rows, four to six yards apart, and usually sustained against trellises or stakes.

VIOLET. The genus *Viola*, of which *V. odorata* is the perfumed violet, and *V. tricolor* the heart's ease.

VITELLUS. An occasional covering of the embryo in seeds. The white of the egg.

VITREOUS HUMOUR. The fluid or humour which fills the posterior chamber of the eye.

VITRIOL. An old name for the sulphates.

VITRIOL, OIL OF. Sulphuric acid.

VIVES. A disease in horses, consisting of an enlargement of the glands at the curve of the jaw, and nearly resembling strangles. It is treated by slight bleeding and purging; and if it does not give way, becomes changed into strangles.

VIVIPAROUS. Producing living young, and not eggs.

VOLATILE ALKALI. Ammonia. See *Nitrogen.*

VOLTAIC ELECTRICITY. Galvanism.

VOLUTE. In architecture, a scroll.

VOLVA. The wrapper or veil of certain fungi, as the agaricus.

VOUSSOIRS. "In bridges, the stones which immediately form the arch, being of the shape of a truncated wedge. Their under sides form the intrados, or soffit. The length of the middle voussoir, or keystone, ought to be about one fifteenth or one sixteenth of the span, and the rest should increase all the way down to the imposts. Their joints should be cut perpendicular to the curve of the intrados; consequently, the angle of the sides is determined by the curvature."—(*Hutton's Tracts*, vol. i.)

W.

WACKE. A hard rock of the basaltic kind.

WAGON. "A wheel-carriage, of which there are several varieties, accommodated to the different uses which they are intended to serve.

"In the business of husbandry, wagons constructed in different forms, and of various dimensions, are made use of in different districts, and mostly without much attention to the nature of the roads, or the articles which are to be conveyed by them, being in general heavy and inconvenient.

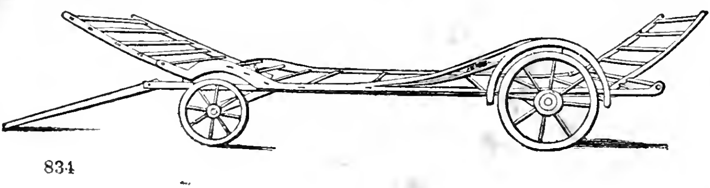
"Wagons require more power in the draught than carts, which is certainly an objection, though they carry a much greater load, and are far from being so handy and convenient; and Mr. Parkinson is of opinion that more work may be done in any particular time, with the same number of horses, by carts than by wagons, on level land, in the general run of husbandry business, especially where the distance is small between loading and unloading; a fact which has long been known and attended to in Scotland.

"Where wagons are used for husbandry, they should be made wide and low. Manures may be carried in this sort of wagon almost as well as in carts. Broad wheels are improper for passing and repassing upon tillage lands; for, if in fallow, they press the land too much, and make it so hard as to prevent its being ploughed; but on grass land broad wheels are proper for all uses, as there they operate as rollers.

"Wagons are probably the best conveyances for different sorts of heavy loads to a distance; but for home business, especially harvest, and other work which requires to be speedily performed in the field, carts with proper shelving will be found preferable."

WAIN. A light harvest wagon. The following (*Fig.*), which is called the Cornwall wain, is an excellent kind.

WAINSCOT. A panelled framing between rooms or against a wall.



WALL. For its uses in horticulture, see *Hot-wall.*

WALL EYE. Opacity of the cornea or glaucoma

WALL-PLATE. A timber lying on a wall on which girders, joists, &c., rest.

WALNUT. The European, or Madeira nut, is the fruit of the improved *Juglans regia*, a very large tree. It does not bear well until some 15 or 20 years old. It is suggested to graft them by approach with bearing branches of an older tree. The wood is very valuable for cabinet purposes, and especially sought for gun stocks; it is not, however, of the rich colour of the American walnut (*J. nigra*), or black walnut. The hulls of the fruit are rich in tannin, and used in France to dye brown colours.

The black walnut is not found north of New-Jersey, but exists in immense quantities in the woods of Virginia, Ohio, Tennessee, and in rich soils, where it attains an altitude of 70 feet, and a circumference of five to seven feet. The fruit is well known, but rather inferior to that of the European tree; the wood is, however, better, and extensively employed.

WARBLES. Black sores, sitfast. See *Galls.*

WARP. The sediment of rivers or the sea. In weaving, the long threads which run the lengthway of the fabric.

WARPING. "A mode of producing a deposition of the earthy matter suspended in rivers of which the current is frequently changed by the rising and falling of the tide. This causes a stirring of the water, which prevents the finer particles from being deposited. It is only necessary to produce a stagnation of the water for a few hours to have a copious deposite, leaving the water clear over it.

"On the low flats which border the mouths of rivers occasional inundations often cause a deposite which is highly fertilizing. Thus, the polders in Holland and Flanders have been formed of the mud of large rivers, and, being drained and kept dry by dikes and sluices, have formed the most fertile soils.

"Warping is an imitation of this natural process: a bank of earth is raised along the course of the river, so high that the floods cannot pass over it. In some part of this dike is a sluice for the double purpose of letting in the water and letting it out at pleasure. When the tide is setting in and counteracting the natural current of the river, the sluice is opened, and the water flows in by one or more channels made for the purpose of conveying it over the lower land, and covers it to the depth of high water. The sluice is now shut, and the imprisoned water, becoming stagnant, deposites all the mud which it held suspended before. The sluice is opened at low water, and the water is allowed to run out slowly; it leaves a coating of mud or sediment, which hardens and dries rapidly. This operation is repeated until a thickness of several inches of new soil has thus been warped, when it is allowed to dry, and then ploughed and cultivated like any other field. It takes some time before any corn will grow on the new warp: at first it looks like barren mud, but it soon dries to a better texture, and ultimately produces very extraordinary crops. If its fertility decrease, and its surface is still below high-water mark, a slight warping, like the inundations of the Nile, immediately restores the fertility. What is curious is the almost total absence of organic matter in the warp soils, or, rather, its intimate combination with the earths, so that it is not readily separated from them. It is neither like clay nor sand, but something between the two, soft to the touch, but not hardening into lumps when dry; neither very porous nor very retentive of moisture. The principal earth is silica in a very fine state. It generally contains a portion of calcareous matter, probably from comminuted shells. It produces oats, beans, potatoes, and wheat in abundance, without any manure. It is admirably adapted to the growth of flax, especially when the warp is of a good depth.

"The principal expense in warping is the sluice, and the canal through which the water is conducted over the land; the longer this latter is, the slower the process, as much warp is deposited in the canal, which has sometimes to be dug out. Accurate levels must be taken, or much expense may be incurred uselessly, if the water will not cover the surface to a sufficient depth.

"It is of little consequence what the soil was originally, for a new soil is deposited over it. It should, however, not be too wet nor marshy: a porous soil is best, as this becomes the subsoil. All the inequalities which existed before are obliterated by the warping, which fills up all cavities, and leaves a perfectly level surface."

WARREN. A place in which rabbits or other game are preserved, or in which they are naturally found.

WASH. The fermented liquor from which the spirit is distilled.

WASHER. In building, a plate of iron set between a wall and timber, and the nut of a screw.

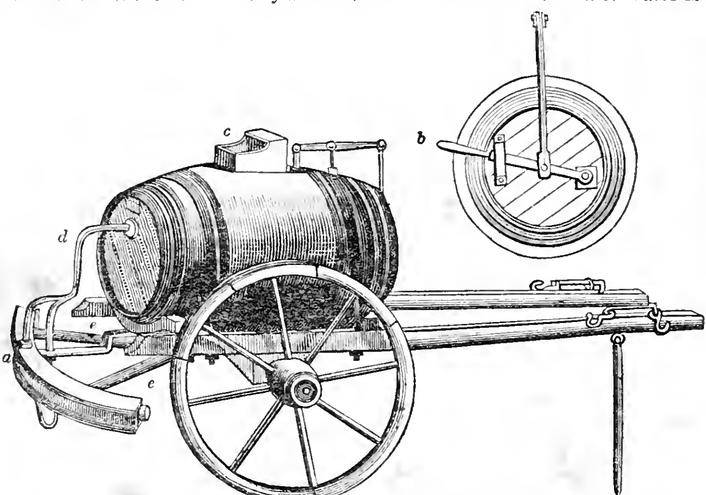
WASPS. The genus *Vespa:* the *V. crabro* is the hornet. They are injurious to agriculture, inasmuch as they destroy bees and eat fruits, especially grapes, and those of thin skins. The greater number die at the approach of winter, only a few females surviving in the nests.

WATER. That of rivers and wells is impure, from containing mineral matters drawn from the soil. Melted snow and rain water are purer, but contain ammonia, gases, and a small amount of salts. It is only to be obtained pure by frequent distillation, and then consists of one equivalent of hydrogen and one of oxygen, or one part by weight of the former and eight of the latter. Its influence on vegetables need not be dwelt upon.

WATER CHESTNUT. The *Scirpus tuberosus*, a rush cultivated in China and Italy for its root, which resembles a chestnut. It grows in ponds and ditches.

WATER-CRESS. See *Cress*.

WATERING CART. This is no more than a common barrel, of large size, set on a cart or on wheels (*Fig.*), and furnished with a tin tube, *a*, bored with numerous holes, for the distribution of water. A valve, *b*, is placed between the distributing tubes and the interior of the barrel. The water is



introduced by a hose at *c*, the tubes for distribution are supported by the rod, *d*, and the water flows from the barrel by *e* and *e*.

WATER MEADOWS. See *Irrigation*.

WATERMELON. See *Melon, Water*.

WATER OF CRYSTALLIZATION. Water contained in crystals.

WATER PLANTAIN. The genus *Alisma*, consisting of useless water weeds.

WATERING PLANTS. The application of water by the common watering-pot to garden vegetables is not a practice altogether safe or useful. Where it is persevered in, and the soil is well worked, it may produce good results; but if not cautiously applied, the soil is rendered stiff. It is cooled by the water, and, should it want drainage, stagnant water is accumulated. It should only be done after sunset, and with rain water collected in tanks and exposed to the air. Newly-planted vegetables require watering.

WATER WHEEL. An engine for raising water in large quantities. Also, a wheel turned by the force of running water. Of these there are two kinds: the *undershot wheel*, and the *overshot wheel*. In the case of the undershot wheel, the water strikes the float boards below the axle, and acts by the impulse due to its velocity; in the case of the overshot wheel, the water is brought over the top of the wheel, received in buckets, and acts solely by its weight.

WAVELLITE. A mineral of a radiated or stellated character, consisting of a hydrated phosphate of alumina.

WAX. A hydrocarbon, composed of $C_{23}\ H_{20}\ O_1$, insoluble in water, and but slightly affected by most acids. It is obtained from plants and from bees' wax. It is prepared by draining and then washing the honeycomb, and finally melting in hot water. The yellow product is bleached by being run into strips, and exposed to the air until whitened sufficiently.

WAX MOTH. See *Bee Moth*.

WAYFARING-TREE. The guelder rose. *Virburnum opulus*.

WEALDEN FORMATION. A portion of the upper secondary, consisting of heavy clays and green sand. It is remarkable for the great number of large saurians it contains.

WEANING. "The means employed to reconcile a young animal to the loss of its mother's milk and habituate it to take common food. The process of weaning calves is variously managed by different farmers. When not let run with the cow, the most advisable mode, as it regards the calf, is to place it loose in a crib, and to suckle it by hand with the mother's new milk, of which it will consume for some time not more than about four quarts per day: the quantity, however, must then be gradually increased, as it will, in the course of a few weeks, require as much as three gallons. If the weather be fine, it should be, within a fortnight or three weeks, turned out daily in the orchard, or some well-sheltered enclosure of sweet herbage; and, as it will in the course of ten or twelve weeks have acquired some relish for the pasture, it may be regularly weaned by gradually diminishing the quantity of milk, and then substituting the skimmed for the new. Calves may, however, be reared with skimmed milk and meal, without any portion of new milk except the first few days' biestings, and many persons give them nothing but water-gruel and hay tea within a fortnight after they have been removed from the cow. Sago and linseed jelly are also very nutritious, and calves may be weaned on them without any other food.

"The time of weaning lambs differs materially, according to the locality of the farms and the quality of the pasture. Four months old is about the period usually selected.

"The lambs should be turned into somewhat better pasture than that to which they had been accustomed, in order to compensate for the loss of the mother's milk. Many farmers are very fanciful as to the provision for the weaned lambs. The clover, or the sainfoin, or the after-math are selected by some; others put their smaller and more weakly lambs to weed the turnip crops; but there can be nothing more desirable than a fresh pasture, not too luxuriant, and yet sufficient to maintain and increase their condition."—(*Youatt on Sheep.*)

WEAR. A fence or dam made of twigs and set in a stream.

WEATHER. "The state or condition of the atmosphere with respect to heat, cold, dryness, moisture, wind, rain, snow, fogs, &c. The appreciation of the various causes which determine the state of the atmosphere, and produce those changes which are incessantly taking place in its condition, and which are popularly called the *weather*, forms the subjects of *Meteorology* and *Climate*. (See those terms; also, *Atmosphere*, *Barometer*, *Cloud*, *Dew*, *Hail*, *Rain.*)

"In all ages of the world, mankind have attempted to explain and prognosticate the changes of the weather; but such is the complication of the subject, and the vast multitude of circumstances to be taken account of, that no theory can furnish rules for determining the order in which they succeed each other, or for predicting the state of the weather at a future time, with any approach to certainty. Nevertheless, all the different modifications of the atmosphere are the necessary results of principles not only fixed and unalterable in their nature, but (many of them at least) well known in their separate and individual operation. The difficulty of tracing the results of their combined influences arises chiefly from their complexity and endless concatenation.

"The principal cause of all the variations which take place in the state of the atmosphere is the heating action of the sun's rays; but in order to appreciate correctly its effect, it is necessary to know not only the extent of the atmosphere, but the properties of all the substances of which it is composed. Modern science has discovered that the atmosphere is composed of three different gaseous fluids, everywhere combined in the same proportions, and penetrated by an ever-varying quantity of elastic vapour. These two distinct envelopes of air and vapour mechanically mixed have different relations to heat; and therefore, in consequence of the unequal temperature of the surface of the earth, with which they are in contact, they cannot both be in a state of equilibrium at the same time. In consequence of the diurnal rotation, the different parts of the atmosphere are constantly receiving different quantities of heat, as the solar rays penetrate more or less obliquely. This inequality of temperature produces winds, which, if the surface of the earth were perfectly regular and homogeneous, would always blow in the same direction; but the surface of the earth being composed of materials of various kinds, and irregularly disposed, the distribution of heat over it is extremely irregular. The winds, sweeping along the surface, acquire its temperature; and hence the atmosphere also becomes irregularly heated. This produces an accumulation of air at one place, and a deficiency at another; and hence a subsequent rush to restore the equilibrium. As the air is cooled it becomes also incapable of holding the same quantity of aqueous vapour, a portion of which is therefore set free, and gives rise to clouds, mist, rain, dew, snow, &c. Besides all this, there is to be taken into account the development of electricity; the influences of light and galvanism; the agitation of the atmosphere produced by the rise and fall of the tides; and probably a variety of other circumstances with which we are entirely unacquainted. This very imperfect enumeration may serve to give an idea of the difficulties to be overcome in forming a theory of the weather.

"It has always been a favourite prejudice that the weather is influenced in some mysterious manner by the moon. The moon can be supposed to act on the earth only in one of three ways; namely, by the light which it reflects; by its attraction; or by an emanation of some unknown kind. Now, the light of the moon does not amount to the 100,000th part of that of the sun; and the heat which it excites is so small as to be altogether inappreciable by the most delicate instruments, or the best devised experiments. No effect can be attributed, therefore, to the moon's light. With a regard to the attraction of the moon, we see its influence on the tides of the ocean, and might therefore be disposed to allow it a similar influence on the atmosphere; but when we take into account the small specific gravity of atmospheric air in comparison with water, and the consequent smallness of the mass of matter to be acted upon, it will readily be perceived that this influence also must be extremely feeble. In fact, it has been demonstrated by Laplace that the joint action of the solar and lunar attraction is incapable of producing more than an atmospheric tide flowing westward at the rate of about four miles a day, and consequently scarcely, if at all, appreciable. As to the remaining supposition, that the moon may act on the atmosphere by some obscure emanation, it is sufficient to remark that no meteorological observations that have yet been made afford the slightest traces of any such connexion between the earth and its satellite. The registers which are now kept in various observatories and other places also prove, contrary to the popular belief, that the changes of weather are in no way whatever dependant on the lunar phases."

WEATHER-BOARDING. Boarding nailed either upright or horizontally, and lapping on the outside of the framing.

WEATHER GLASS. See *Barometer*.

WEDGE. One of the simple mechanical powers, the efficiency of which is proportional to the length of the side. Knives are wedges.

WEEDS. "Every plant which grows in a field other than that of which the seed has been sown by the husbandman is a weed, and, inasmuch as it interferes with the intended crop, should be carefully eradicated. It is a proof of good cultivation when few weeds appear among the growing crops, and many of the operations of tillage are intended chiefly for their destruction. One of the principal uses of summer fallows is to destroy the weeds which come up in spring, and which would shed their seeds in summer if they were not destroyed before the seeds ripen. When roots are sown in drills and carefully hoed, they produce the same cleansing effect, and supersede the fallow; but in heavy loams which have been neglected and overrun with weeds, a clean fallow is sometimes indispensable, before any improved method can be adopted. When a farmer enters on lands which are in a foul state, it is the cheapest way, in the end, to sacrifice a crop, and thoroughly purge his fields from weeds, especially those which have vivacious roots, and cannot be extirpated by simple ploughing. The mode of doing this must depend on the nature and duration of the weeds, whether their roots are perennial, or die off after the plant has borne seed. Annual weeds are most readily extirpated by repeated harrowings, by which the seeds are brought within the influence of the atmosphere, and when they have fairly vegetated may be buried or rooted out, and by exposing their roots to the influence of a hot sun they are effectually destroyed. The seeds of annual weeds are chiefly brought on the land in the manure which is made in the yards, where the cattle fed on hay or straw swallow the seeds, which pass through them undigested. By exciting a great degree of fermentation in the mixture of dung and litter some of the seeds may be destroyed, but many of them will keep their vegetative powers even after having been exposed to a considerable heat; and as it is not advisable to let the manure undergo a great degree of decomposition before it is carried on the land, many seeds always escape destruction, and vegetate as soon as they are placed in a favourable situation. Those which are buried deep lie dormant for a long time, and vegetate as soon as the plough brings them up again.

"The experienced farmer knows well what peculiar species of weeds infest his fields, according to the soil and situation; and by studying their habits, time of flowering, and of ripening their seed, he learns the best mode of destroying them.

"One of the greatest advantages of composts made with human excrements mixed with earths and mineral substances is, that they introduce no weeds into the soil. It is reported that in China, where the dung of cattle is little used, in comparison with human excrements, no weeds are to be found in the fields; and if more attention were paid to the preservation of this highly enriching manure, and its proper application to the soil, much expense would be saved which is now unavoidably incurred in destroying weeds.

"Feeding sheep on roots and corn, while they are folded on the land, is another mode of manuring a field, without introducing weeds, especially if no hay is given them, except clover hay of the second crop, which is generally most free from the seeds of weeds. It would be impossible to enumerate all the various weeds which may infest our fields. This would be giving a flora of all the British plants; but we will select some of the most common and troublesome to the farmer, with such an account of each as may suggest the most ready means of destruction.

"Of the annual weeds, we may mention the following, noticed by Professor Low, in his Elements of Practical Agriculture:

"*Sinapis arvensis*, or wild mustard, usually called charlock, is a weed the seeds of which, being of an oily nature, will remain dormant in the soil for an indefinite time, if buried above six inches. Hence some farmers fear to deepen their ploughings, which otherwise would be very advantageous, because they have found that, in some soils, a ploughing beyond six inches deep will cause the crop to be overrun with charlock, so as to choke it with its yellow flowers. It only requires a little resolution, and an outlay which will be well repaid in the end, to destroy this enemy Hoed crops will destroy the plants as they come up. Winter tares, which may be cut before the charlock perfects its seeds, will help to destroy it, and if they are succeeded by turnips, there will be little charlock left in autumn. Wherever it appears and raises its yellow flower it must be pulled out, whatever be the cost, and care must be taken to carry the plants out of the field to burn or rot them; for the seeds will vegetate when they are but half ripe in the pods. We have dwelt at length on this weed, because it is one which infests many of our best soils, and which must be eradicated before the land can be properly cultivated.

"Somewhat allied to the last is the wild radish (*Raphanus raphanistrum*), which is often also called charlock: the mode of destruction is the same.

"*Papaver rhœas*, or corn poppy, infests some soils in particular seasons. If the seed is allowed to ripen and shed, it will increase rapidly; good tillage, however, soon destroys it; clover and tares which are cut while the poppy is in flower generally eradicate it. In some seasons it will appear in great profusion, and in others not a plant will be seen.

"*Centaurea cyanus*, or blue-bottle, is seldom found in any quantity, except where there is a slovenly culture, or two white crops are taken in succession, a practice which, it is hoped, will soon be obsolete.

"*Chrysanthemum segetum*, corn marigold, infests some soils, and must be eradicated by careful weeding; when the crops are drilled, this is not a difficult task.

"*Pyrethrum inodorum*, corn feverfew, often called May-weed, as is also the wild camomile, often infests the crops of grain, and with every care in weeding, some of the seeds will be carried to the barn. We may here observe, generally, that where the grain is reaped by the sickle and a long stubble is left, the seeds of weeds remain on the land, and although some of them are eaten by birds, yet many are ploughed in after the stubble has been raked off or mown; whereas, if the corn is mown or cut close to the ground, which is called fagging or bagging it, all the weeds are tied up with the corn, and go into the barn or stack; and if care be taken in the winnowing and sifting of the corn to separate the smaller seeds from the straw and burn them in a heap, the straw will be clean and the dung of the cattle will contain no seeds of weeds. This is by far the best mode of proceeding; and by careful hoeing and weeding, and burning the small seeds, the land may be kept tolerably free from seed weeds.

"The sow thistle (*Sonchus oleraceus*) often raises its head above the oat. The seeds are blown about by the winds, and if the hedges and headlands are not kept clear of them, they will sow themselves in all directions; but it is a conspicuous plant, and easily pulled out by hand before its flower expands. To destroy thistles, in general, it is only necessary to cut them down just as the flower is expanding; the roots will then die, and in a few years, by the united attention of the farmers in a district, thistles may easily be eradicated. In some places the infirm paupers are employed in pulling up all the thistles in the hedges which border the roads, and wherever they make their appearance in the highways and lanes of a parish. This practice cannot be too generally recommended, for the hedges and ditches, and the sides of roads and lanes, are often perfect nurseries of weeds.

"*Arctium lappa* (burdock) is a very common weed in fields; but with a little care it is easily extirpated.

"*Agrostemma githago*, or corn cockle, is a very injurious weed, because its seeds ripen about the time of harvest, and, from its size, cannot be easily separated from the wheat by sifting; it contains a farina, which is oily, and, when ground with the corn, greatly deteriorates the flour. The only mode of extirpation is by hand-weeding.

"*Stellaria media*, or common chickweed, is a small plant which grows profusely on light soils which have been abundantly manured. If it be allowed to overspread the ground, it will choak the young crops, especially turnips, carrots, and all slow-growing seeds. Drilling the crops and early hoeing them is the best means of destroying this weed; as soon as the crop gets above the chickweed, it is soon destroyed, if the latter covers the ground well. It often does harm to young clover, but the latter soon overpowers it. Tares smother it readily. The same observations are applicable to the *Spergula arvensis*, or corn spurrey, a larger variety of which, however, is cultivated as excellent food for milch cows.

"*Galium aparine*, or goose grass, also called cleavers, is a weed which is dispersed by the seeds attaching themselves to the wool of sheep by means of hooks with which they are provided. They increase rapidly in some soils, if they are not carefully pulled up and the hedges cleared of them.

"*Urtica urens*, stinging nettles, generally grow where the ground has been strongly manured, especially where heaps of dung have lain. They are seldom very troublesome, and are easily eradicated by repeated ploughing; they infest gardens more than fields.

"*Polygonum convolvulus*, climbing buckwheat, is a very troublesome weed, which winds round the stems of the corn, and often overtops them. The seeds are said to be nutritious, and not to injure the oats when mixed with them; but in wheat it is very destructive, and diminishes the product while it injures the quality of the corn.

"All the common grasses are weeds in cornfields, and in the alternate husbandry are introduced in the regular cultivation. When the grass is ploughed up, if the sods are not covered sufficiently so as to rot, tufts of grass remain, which greatly increase, to the injury of the next crop. However carefully the land may be ploughed, if it be sown immediately, the roots of grass will be raised to the surface by the harrows. The only remedy is to have them carefully forked out, and carried to some corner or waste spot, there to form the foundation of a dung heap or compost. When the land is ploughed up before winter, and the seed sown in spring, the grass will be rotten and have lost its vegetative power.

"The bearded wild oat (*Avena fatua*) is a very troublesome plant, and sometimes almost exceeds the true oat in quantity; but this can only be the case with very slovenly farmers. It ripens sooner than the corn, and sheds its seeds before harvest. Crops cut green for fodder, such as rye, winter barley, and tares, repeated if necessary, soon destroy this weed, which has no perennial root.

"These are some of the most common annual and biennial weeds. They may all be easily destroyed by weeding at the time when they have pushed up their seed stems and the flower is about to expand; if they are cut up at that time they seldom recover. Hoeing them when very young, unless the weather be dry enough to scorch the roots exposed, often increases them instead of killing them. But the last-mentioned weeds are easily got rid of in comparison with those which have perennial roots, and some of which increase the faster the more the roots are divided. It may be proper to observe, that too little attention is paid to the weeds in our upland meadows and pastures. One would imagine that every plant which increases the weight of the hay or covers the ground in spring is wholesome for cattle, whereas many are detrimental when they are eaten for want of better food. Of this kind are the ranunculi, commonly called butter-cups, which, far from deserving this name, are never touched by the cows, so long as they can find other food. Without going the length of ascribing to the butter-cups the power of causing epidemic diseases in cattle, and even in men who eat of the milk and butter of cows who have eaten them, there is no doubt that where the cows are forced by hunger to eat many of them, they may be very injurious to their health, and to the production of good milk. As these plants have strong perennial roots, they take possession of rich, moist soils, to the exclusion of good grasses. When not very abundant, the plants may be weeded out by means of a sharp spud or hoe, and the expense will be well repaid in the quality of the hay or pasture. Where they are very abundant, the only remedy is to break up the grass in autumn, let it be exposed to the frost in winter, take a crop of corn next season, and lay it rough again the winter after. In the succeeding spring the land may be inoculated with good tufts of grass, and before the next year an improved pasture will have been formed; or, if this is too much trouble, it may be summer fallowed, and sown in August with pure seed of the best grasses. This is expensive, as a whole year's produce is lost, but the subsequent pasture will be so much better, that the expense may be considered as a profitable investment. The most common species of butter-cup are the *Ranunculus acris*, *repens*, and *bulbosus*: the *R. flammula* is highly poisonous, but not common, except in marshy pastures.

"*Senecio Jacobæa*, or rag wort, is another troublesome weed; but as sheep eat it readily when young, it is easily kept down by pasturing and folding. In moist weather, also, it is easily pulled up by hand.

"*Tussilago farfara*, colt's foot. By its large leaves it kills the finer grasses under it. As moisture is essential to its luxuriance, draining tends to diminish its growth; careful manuring, also, makes the grasses get the better of it, and choke it when young.

"*Chrysanthemum leucanthemum*, or great white one eye, sometimes abounds in inferior pastures, and is only extirpated by tillage and improving the soil by manuring it well.

"We have already mentioned annual and biennial thistles, but the perennials, such as the *Cnicus arvensis* and *Sonchus arvensis*, or corn thistle and sow thistle, are much more difficult to eradicate, as the roots strike deep in the ground and throw up fresh shoots every year. The most effectual mode of destroying them is to draw them out with an instrument like large pincers, made of wood or iron, and called 'a thistle-drawer,' the form of which is well known, and which may be had in most ironmongers' shops. The time to draw the thistles is when the stem is grown sufficiently to give a good hold of the crown of the root. Great care must be taken not to break the root too near the ground, but to draw it out completely. In ploughing, also, a broad and sharp share, cutting horizontally seven or eight inches below the surface, will cut off the long roots, so as to prevent their making fresh shoots; and when this is done while the thistle is in a growing state, the root will bleed and be destroyed. In grass land they are soon destroyed, if they are carefully cut down with a scythe just as the flower is expanding, and before the seed is formed. If this is done for two or three years, not a thistle will be seen; but then all the neighbouring farmers must agree in a general war upon thistles, whether on the land or in the hedgerows.

"The dock (*Rumex obtusifolius* and others) is another most troublesome weed, both in fields and pastures, and is only to be eradicated by similar means with the thistle. Docks are often left in the field after harvest, where they shed their seed at leisure, whereas they should be collected with as great care as the corn itself, and invariably be burned in heaps; this is the only sure means of destroying the seed. They are often thrown into the roads, supposing that they will be crushed by the wheels of carts passing over them; but it must be remembered that birds may swallow them, and void them again with their vegetative powers uninjured, if not improved; and that thus they are again sown on the land. Nothing but burning is a sure destruction of the seeds.

"*Centaurea nigra*, black knapweed or horse-knot, is a coarse plant which chiefly infests pastures, and takes up the room of useful grasses, most animals refusing to eat it. It is only to be eradicated by pulling the plants up by the roots or cutting them close to the ground wherever they appear. Manuring the surface highly and mowing the grass soon makes them disappear.

"*Polygonum amphibium*, commonly called amphibious persicaria, is found on very wet land, and is best destroyed by draining.

"Besides the common couch grass (*Triticum repens*), which is the pest of farmers on light soils, there are a variety of plants which spread both by the roots and by creeping along the surface; of this kind are the different sorts of *quitches*, as they are provincially called, which grow in wet soils. Of these, the *Agrostis stolonifera*, once so highly praised as fodder under the name of *fiorin*, and the *Agrostis alba* (March bent grass), are the most common; when they take possession of a spot they exclude all other grasses. The only mode of extirpating these last is draining and careful tillage. But to return to the common couch. This weed sometimes takes such possession of the soil that nothing else can thrive in it. It is not a single fallow or cleaning which will get rid of it, but a regular system. Ploughing does often more harm than good, by dividing the root (which is, in fact, an underground stem), and thus increasing the number of plants. The most effectual means of destruction is by the fork. If, after the ground has been once ploughed, it be forked up carefully in dry weather, and the tufts of couch, with their roots, be exposed to the hot sun, they may be raked off and burned; but as these roots contain much nutritive saccharine matter, it is often worth while to wash them, if the adhering earth cannot be beat out, and to give them to horses and cattle to eat, taking care that the litter and dung made at that time be reserved to manure grass land, and not arable fields. Heaps of couch may be rotted by pouring urine or the drainings of dunghills over them; and if they are frequently turned, will produce a rich compost. Any inconvenience from the extreme vitality of the roots is obviated by using this compost, mixed with earth, as a top-dressing for pastures.

"Another weed with perennial and very vivacious roots is the *Arrhenatherum avenaceum*, common oat-like grass. The root is bulbous, and the bulbs, separated, grow again. It is difficult to eradicate, but the means employed to get rid of the couch grass will succeed with this and most other perennial roots. These troublesome weeds may have been wisely dispersed through the soil by Providence, to induce the cultivator to give his land a more perfect tillage than he might have done otherwise. The expense of forking, and what is usually called couching, is generally amply repaid by the finer tilth it gives to the land, and the crops are more certain and abundant in consequence.

"There are many other weeds, both in arable and pasture land, which indicate slovenly culture, and which disappear on careful cultivation; such as briars, furze, broom, and rushes, the last being a well-known sign of superabundant moisture, and only to be destroyed by under-draining. The whole process of cultivation is a continual struggle between the farmer and the weeds natural to the soil he cultivates. The sooner he subdues them entirely, the less will be his subsequent trouble; and the perfection of agriculture is to produce crops of such vegetables as are useful and profitable, and are suited to the soil which is cultivated, while all others are excluded which might interfere with the crops to be raised. That much remains yet to be done in this respect on farms which are looked upon as models of cultivation will be acknowledged on simple inspection. The almost universal adoption of the system of drilling and hoeing the crops tends greatly to the destruction of useless plants on arable land; much yet may be done by way of improving the produce of meadows and pastures by the destruction of all noxious and useless plants, and the introduction of those which are nutritious and improve the herbage, whether depastured or made into hay; and nothing is so likely to do so as a good system of alternate husbandry, where the best grasses are cultivated as carefully as the plants which are immediately applied to the food of man."

WEEVILS. The true weevils are coleopterans of the family *Rhynchophoridæ*, distinguished by the head being prolonged into a snout, and sometimes into a narrow tube. The grain weevils will be found figured in the article on *Insects*. The weevils are all destructive to grain and trees, the *Hylobius pales*, *picivorous*, &c., being particularly injurious to pine-trees. They are, however, the food of numerous woodpeckers, which keep down their numbers. The pine weevils appear in the fall, from August to October.

WEIGH. A common term for a certain quantity of produce, which is, however, indeterminate.

WEIGHTS AND MEASURES. "*System of Lineal Measures.*—The unit of lineal measure is the yard, all other denominations being either multiples or aliquot parts of the yard. The yard is divided into 3 feet, and the foot subdivided into 12 inches. The multiples of the yard are the pole or perch, the furlong, and the mile; $5\frac{1}{2}$ yards being a pole, 40 poles a furlong, and 8 furlongs a mile. But the pole and furlong are now scarcely ever used, itinerary distances being reckoned in miles and yards.

"The relations of these different denominations are exhibited in the following table:

Inches.	Feet.	Yards.	Poles.	Furlongs.	Miles.
1	0·083	0·028	0·00505	0·00012626	0·0000157828
12	1	0·333	0·06060	0·00151515	0·00018939
36	3	1	0·1818	0·004545	0·00056818
198	16·5	5·5	1	0·025	0·003125
7920	660	220	40	1	0·125
63360	5280	1760	320	8	1

"Of the different measures of length used, the foot is the most universally prevalent. We subjoin the relation between the foot of different countries and the English foot.

	English foot.
Russian foot	1·
Paris foot	1·065765
Prussian and Danish foot .	1·029722
Austrian foot	1·037128

"*Measures of Superficies.*—In square measure the yard is subdivided, as in general measure, into feet and inches; 144 square inches being equal to a square foot, and 9 square feet to a square yard. For land measure, the multiples of the yard are the pole, the rood, and the acre; 30¼ (the square of 5½) square yards being a pole, 40 poles a rood, and 4 roods an acre (see *Acre*). Very large surfaces, as of whole countries, are expressed in square miles.

"The following are the relations of square measure:

Square Feet.	Square Yards.	Poles.	Roods.	Acres.
1	0·1111	0·00367309	0·000091827	0·000022957
9	1	0·03305798	0·00082641	0·000206612
272·25	30·25	1	0·025	0·00625
10890	1210	40	1	0·25
43560	4840	160	4	1

"Land is usually measured by a chain of 4 poles, or 22 yards, which is divided into 100 links. Three chains in length, and one in breadth, make an acre, which equals 169 square perches, or 4840 square yards.

Square, or Superficial Measure.

144	square inches	=	1	square	foot.
9	" feet	=	1	"	yard.
30½	" yards	=	1	"	rod.
40	" rods	=	1	"	acre.
640	" acres	=	1	"	mile.

"*Measures of Volume.*—Solids are measured by cubic yards, feet and inches; 1728 cubic inches making a cubic foot, and 27 cubic feet a cubic yard. For all sorts of liquids, corn, and other dry goods, the standard measure is declared by the act of 1824 to be the imperial gallon, the capacity of which is determined immediately by weight, and remotely by the standard of length.

"The parts of the gallon are quarts and pints, 2 pints being a quart, and 4 quarts a gallon. Its multiples are the peck, the bushel, and the quarter; the peck being 2 gallons, the bushel 4 pecks, and the quarter 8 bushels.

Pints.	Quarts.	Gallons.	Pecks.	Bushels.	Quarters.
1	0·5	0·125	0·0621	0·015625	0·001953125
2	1	0·25	0·125	0·03125	0·00390625
8	4	1	0·5	0·125	0·015625
16	8	2	1	0·25	0·03125
64	32	8	4	1	0·125
512	256	64	32	8	1

Cubic, or Solid Measure.

1728 cubic inches make . . 1 cubic foot.
27 cubic feet . . . . . 1 cubic yard
40 feet of rough timber }
50 feet of hewn timber } 1 load.

"This comprehends length, breadth, and thickness.

"And 108 solid feet, that is, 12 feet in length, 3 feet in breadth, and 3 feet deep, or, commonly, 14 feet long, 3 feet 1 inch broad, and 3 feet 1 inch deep, are a stack of wood.

"And 128 solid feet, that is, 8 feet long, 4 feet broad, and 4 feet deep, are a cord of wood.

Grain Measures.

Countries.	Bushels	No. of equal to English Quarters.	Name of Measure.
England .	1·000	8·000	
Scotland .	1·022	7·827	
France .	4·427	1·807	Setier.
Holland .	3·157	2·534	Mudde.
Prussia .	1·479	5·409	Scheffel.
Spain . .	1·599	5·003	Fanaga.
Poland . .	1·451	5·513	Korzee.

English Corn Measures.

4 gills	=	1 pint	=	34⅝	cubic in.
2 pints	=	1 quart	=	69¼	"
4 quarts	=	1 gallon	=	277¼	"
2 gallons	=	1 peck	=	554½	"
8 gallons	=	1 bushel	=	2218¼	"
8 bushels	=	1 quarter	=	10¼	cubic ft.
5 quarters	=	1 load	=	51¼	"

"The Winchester quarter is more than the imperial quarter, being in the proportion of 1 to 0·96945. The English imperial quarter, in estimating weight, means the ¼th of a ton of 2240 lbs.=560 lbs., or 1 quarter.

"*Measures of Wood and other Fuel.*—Cord-wood, being the bigger sort of fire-wood, is measured by a cord or line, whereof there are two measures: that of 14 feet in length, 3 feet in breadth, and 3 feet in height; the other is 8 feet in length, 4 feet in breadth, and 4 feet in height, which is generally employed.

Table of Weights and Measures according to the Imperial Standard.

Avoirdupois weight.			French grammes.
	1 drachm	=	1·771
16 drachms	1 ounce	=	28·346
16 ounces	1 pound	=	453·544
28 pounds	1 qr. cwt.	=	12·699 kilogram.
4 quarters	1 cwt.	=	50·796
20 cwt.	1 ton	=	1015·920

"The stone is generally 14 lbs. avoirdupois weight, but for butcher's meat or fish it is 8 lbs. Hence the cwt. equals 8 stone of 14 lbs., or 14 stone of 8 lbs.

"*Wool Weight.*—Like all other bulky articles, wool is weighed by avoirdupois weight, but the divisions differ thus:

7 pounds	=	1 clove.
2 cloves	=	1 stone.
2 stone	=	1 tod.
6½ tods	=	1 wey.
2 weys	=	1 sack.
12 sacks	=	1 last.

"Cheese and butter,

8 pounds	=	1 clove.
32 cloves	=	1 wey in Essex.
42 cloves	=	1 wey in Suffolk.
56 pounds	=	1 firkin of butter.

"A cubic foot of loose earth or sand weighs 95 lbs.

A cubic ft. of		common soil	weighs	124	lbs.
"	"	strong soil	"	127	"
"	"	clay	"	135	"
"	"	distilled water	"	62·5	"
"	"	cast iron	"	450·45	"
"	"	lead	"	709·5	"
"	"	copper	"	486·75	"

A cubic foot of		tallow	weighs	59	lbs.
"	"	oak	"	73·15	"
"	"	brick	"	125	"
"	"	air	"	·0753	"

"The quintal is 100 lbs.; the ton 2240 lbs.

"The weight of a cubic inch of distilled water, in air, is 252·458 grains.

"The Turkish pound is 7578 grains; the Danish, 6941; the Irish, 7774; the Neapolitan, 4952; the Scotch pound troy, 7620·8.

"The imperial gallon contains 10 lbs. avoirdupois of distilled water, weighed in air at 62°, with the barometer at 30 inches. 2 gallons are equal to a peck, 8 gallons to a bushel, and 8 bushels to a quarter.

"Heaped measure, per bushel, is 2815½ cubic inches clear.

"The Winchester bushel is 18½ inches in diameter, and 8 inches deep, containing 2154·42 cubic inches.

"1000 ounces of rain water are equal to about 7½ gallons wine measure, or to a cubic foot.

"7 pounds avoirdupois are a gallon of flour.

"A chaldron of coals is 58⅔ cubic feet.

"12 wine gallons of distilled water weigh 100 lbs. avoirdupois.

"The imperial dry bushel, when not heaped, is 2218·192 cubic inches; the peck, 554·548; gallon, 277·274; and quart, 69·3185. The bushel is 8 inches deep, and 18·8 wide, with a heap 6 inches high.

"A bushel of wheat is 60 lbs.; rye, 53 lbs.; barley, 47 lbs.; oats, 38; pease, 64; beans, 63; clover seed, 68; rape, 48 lbs.

"A Scotch pint is equal to 4 English pints.

"A Scotch quart is 208·6 cubic inches.

"There are 545,267,000 cubic yards in a cubic mile.

"According to usage, in Philadelphia and other parts of the United States, building-stone, when piled or 'perched,' as it is usually termed, is measured by allowing 25 cubic feet to the perch; but when placed in the wall, only 22 feet are allowed to the perch. In measuring stone wall, 14 inches of thickness is usually allowed. When the thickness of the wall exceeds 14 inches, the extra thickness is estimated, and made an additional charge. This is the common rule when the walls have only one face. In double-faced walls there is commonly an allowance of about one third more. 3 pecks of good lime will generally suffice to lay 1 perch of stone wall. About 2 one-horse loads of sand are allowed to make mortar for 3 perches of stone wall.

"To convert cubic feet into perches, divide by 25; or, what is still more easy, multiply by ·04.

"In brick-work, 14 bricks are usually allowed to the cubic foot: sometimes only 13 are allowed. To convert cubic feet into cubic yards, divide by 3, and the product by 9.

"*Lumber Measure.*—In estimating the number of feet in a board, the length in feet is to be multiplied by the width in inches, and the result, divided by 12, shows the contents in feet. When boards are more than 1 inch thick, all over is added. A board 12 feet long and 1¼ inch thick would of course be estimated to contain one fourth more than a board only 1 inch thick.

"*Capacity Measures.*—Wine gallon, 231 cubic inches; beer gallon, 282 cubic inches; bushel, 2150·42 cubic inches; lime bushel, 13½ inches diameter at bottom, 15 inches at top, and 13·47 inches deep. A cord of wood contains 128 cubic feet. A hogshead of cider 110 wine gallons.

"*Weights.*—A Troy pound is equal to that of the United States mint, and the avoirdupois pound bears to it the ratio of 7000 to 576.

60 lbs.	of	wheat pass for a bushel.
58	"	rye.
58	"	corn.
48	"	buckwheat.
47	"	barley.
32	"	oats.
85	"	coarse salt (foreign).
70	"	ground salt.
62	"	fine.
80	"	anthracite coal, 112 lbs. make 1 cwt., and 2240 lbs. = 1 ton.

"If the square of the diameter of a circle be multiplied by ·7854, the product is the area. If the diameter of a sphere be cubed and multiplied by ·6236, the product is the solidity; and the square of the diameter, multiplied by 3·14159, is the surface of the sphere.

"To find the contents of a cask, add double the square of the bung diameter to the square of the head diameter, and multiply this sum by the head of the cask; then divide the product by 1077 for ale gallons of 280 cubic inches each, or by 882 for wine gallons of 231 cubic inches each.

"*Method of ascertaining the Weight of Cattle while living.*—This is of the utmost utility for all those who are not experienced judges by the eye, and by the following directions the weight can be ascertained within a mere trifle. Take a string, put it round the beast, standing square, just behind the shoulder-blade; measure on a foot-rule the feet and inches the animal is in circumference; this is called the girth; then with the string measure from the bone of the tail, which plumbs the line with the hinder part of the buttock; direct the line along the back to the fore part of the shoulder-blade; take the dimensions with the foot-rule, as before, which is the length, and work the figures in the following manner: Girth of the bullock, 6 feet 4 inches; length, 5 feet 3 inches; which, multiplied together, make 31 square superficial feet; that, again, multiplied by 23 (the number of pounds allowed to each superficial foot of all cattle measuring less than 7 and more than five feet in girth), makes 713 lbs.; and allowing 14 pounds to the stone, is 50 stone 13 lbs.; and where the animal measures less than 9 and more than 7 feet in girth, 31 is the number of pounds to each foot. Again, supposing a pig or any small beast should measure 2 feet in girth, and 2 feet along the back, which, multiplied together, make 4 square feet, that multiplied by 11, the number of pounds allowed for each square foot of cattle measuring less than 3 feet in girth, makes 44 lbs.; which, divided by 14, to bring it to stones, is 3 stones 2 lbs. Again, suppose a calf, sheep, &c., should measure 4 feet 6 inches in girth, and 3 feet 9 inches in length, which, multiplied together, make $16\frac{1}{2}$ square feet; that multiplied by 16, the number of pounds allowed to all cattle measuring less than 5 feet and more than 3 in girth, makes 264 lbs.; which, divided by 14, to bring it to stones, is 18 stones 12 lbs. The dimensions of the girth and length of black cattle, sheep, calves, or hogs, may be as exactly taken this way as it is at all necessary for any computation or valuation of stock, and will answer exactly to the four quarters, sinking the offal, and which every man who can get even a bit of chalk may easily perform. A deduction must be made for a half-fatted beast of 1 stone in 20 from that of a fat one, and for a cow that has had calves 1 stone must be allowed, and another for not being properly fat."

"*French System of Weights.*—The French denominations of weight occur so frequently in works connected with the physical sciences, that it is convenient to be acquainted with their values. The unit of weight is the *gramme*, which is the weight of the 100th part of a cubic mètre of distilled water at the temperature of melting ice. A gramme is equal to 15·434 Troy grains; whence the following comparative table of French with Troy weight:

		Grammes.		Troy grains.
Milligramme	=	·001	=	·01543
Centigramme	=	·01	=	·15434
Decigramme	=	·1	=	1·5434
Gramme	=	1	=	15·434
Decagramme	=	10	=	154·34
Hectogramme	=	100	=	1543·4
Kilogramme	=	1000	=	15434
Myriagramme	=	10000	=	154340

"The kilogramme is equal to 2 lbs. 3 oz., 4·428 drachms avoirdupois weight. In the *Systeme Usuel* the standards are the same as the above, but the denominations are those which were anciently in use. It was found impossible to introduce the new terms. The divisions are binary. Half the kilogramme forms the *livre usuel*, which is divided into halves, quarters, eighths, &c., down to the *gros*, which is the eighth of the *once*, or the $\frac{1}{128}$th of the *livre*.

WELD. *Reseda luteola* (*Fig.*). Dyers' weed, or yellow rocket, an annual used for dyeing purposes, es-

pecially for yellow dyes. The following is Loudon's account of its cultivation:

"The soil being brought to a fine tilth, the seed is sown in April or the beginning of May, generally broad-cast. The quantity of seed is from two quarts to a gallon per acre, and it should either be fresh, or, if two or three years old, steeped a few days in water previously to being sown. Being a biennial, and no advantage obtained from it the first year, it is sometimes sown with corn crops in the manner of clover, which, when the soil is in a very rich state, may answer, provided, also, that hoeing, weeding, and stirring take place as soon as the corn crop is cut. The best crops, however, will obviously be the result of drilling and cultivating the crop alone. The drills may be a foot asunder, and the plants thinned to six inches in the row. In the broad-cast mode it is usual to thin them to six or eight inches' distance every way; often, when weld succeeds corn crops, it is never either thinned, weeded, or hoed, but left to itself till the plants are in full blossom.

"The crop is taken by pulling up the entire plant, and the proper period for this purpose is when the bloom has been produced the whole length of the stems, and the plants are just beginning to turn of a light or yellowish colour; as in the beginning or middle of July in the second year. The plants are usually from one to two and a half feet in height. It is thought by some advantageous to pull it rather early, without waiting for the ripening of the seeds, as by this means there will not only be the greatest proportion of dye, but the land will be left at liberty for the reception of a crop of wheat or turnips; but in this case a small part must be left solely for the purpose of seed. In the execution of the work, the plants are drawn up by the roots in small handfuls, and set up to dry after each handful has been tied up by one of the stalks, in the number of four together in an erect position against each other. Sometimes, however, they become sufficiently dry by turning without being set up. After they have remained till fully dry, which is mostly effected in the course of a week or two, they are bound up into larger bundles that contain each 60 handfuls, and which are of the weight of 56 lbs. each, 60 of these bundles constituting a load. These last, in places where this kind of crop is much grown, are tied up by a string made for the purpose, and sold under the title of weld cord.

"The produce of weld depends much on the nature of the season; but from half a load to a load and a half is the quantity most commonly afforded. It is mostly bought by persons who afterward dispose of it to the dyers occasionally as they find it convenient. The demand for it is sometimes very little, while at others it is so great as to raise the price to a high degree. It is sometimes gathered green, and treated like woad or indigo; but in general the dried herb is used by the dyers in a state of decoction.

"The use of weld in dyeing is for giving a yellow colour to cotton, woollen, mohair, silk, and linen. Blue cloths are dipped in a decoction of it, which renders them green; and the yellow colour of the paint called Dutch pink is obtained from weld. It yields a brownish yellow decoction, the colour of which is rendered paler by acids, and richer and deeper by alkalies. Alum throws down a yellow precipitate, and leaves the clear liquor of a fine lemon yellow; tartar also brightens its colour; and solution of tin gives it a dilute green tint. When a mixture of whiting and alum is added to a hot decoction of weld, a yellow precipitate is obtained, which, when collected, washed, and dried, is of a fine delicate colour, and much employed by paper-stainers.

"To save seed, select a few of the largest and healthiest plants, and leave them to ripen. The seed is easily separated.

"The chief *disease* of weld is the mildew, to which it is very liable when young, and this is one reason that it is often sown with other crops."

WELDING. The union of two pieces of metal at a white heat by hammering; iron, steel, and platinum are the only metals susceptible of welding. The surfaces are cleaned by borax in welding steel.

WELL. "Before proceeding to dig a well, it ought first to be determined on whether a mere reservoir for the water which oozes out of the surface soil is desired or obtainable, or a perpetual spring. If the former is the object in view, a depth of fifteen or twenty feet may probably suffice, though this cannot be expected to afford a constant supply unless a watery vein or spring is hit on: if the latter, the depth may be various, there being instances of 300 and 500 feet having been cut through before a permanent supply of water was found.

"The art of well-digging is generally carried on by persons who devote themselves exclusively to that department. The site being fixed on, the ground-plan is a circle, generally of not more than six or eight feet in diameter: the digger then works down by means of a small short-handled spade, and a small implement of the pickaxe kind, the earthy materials being drawn up in buckets by the hand or a windlass fixed over the opening for the purpose. Where persons conversant with this sort of business are employed, they usually manage the whole of the work, bricking round the sides with great facility and readiness; but in other cases it will be necessary to have a bricklayer to execute this part of the business.

"There are two methods of building the stone or brick within the well, which is called the steening. In one of these a circular ring is formed, of the same diameter as the intended well; and the timber of which it is composed is of the size of the brick courses with which the well is to be lined. The lower edge of this circle is made sharp, and shod with iron, so that it has a tendency to cut into the ground; this circular kirb is placed flat upon the ground, and the bricks are built upon it to a considerable height, like a circular wall. The well-digger gets within this circle, and digs away the earth at the bottom; the weight of the wall then forces the kirb and the brick-work with which it is loaded to descend into the earth, and as fast as the earth is removed it sinks deeper, the circular brick wall being increased or raised at top as fast as it sinks down; but when it gets very deep, it will sink no longer, particularly if it passes through a soft stratum: in this case, a second kirb of a smaller size is sometimes begun within the first. When a kirb will not sink from the softness of the strata, or when it is required to stop out water, the bricks or stones must be laid one by one at the bottom of the work, taking care that the work is not left unsupported in such a manner as to let the bricks fall as they are laid; this is called underpinning.

"Well-diggers experience sometimes great difficulty from a noxious air which fills the well, and suffocates them if they breathe it. The usual mode of clearing wells of noxious air is by means of a large pair of bellows and a long leathern pipe, which is hung down into the well to the bottom, and fresh air forced down by working the bellows.

"The use of the auger is common in well-digging, both in ascertaining, before commencement, the nature of the strata to be dug into, and also in course of digging for the same purpose; and because, by boring in the bottom of a well to a considerable depth, the spring is sometimes hit upon, and digging rendered no longer necessary.

"The use of the borer alone may procure an adequate supply of water in particular situations. This mode appears to have been long resorted to in this and other countries. From what we have already stated as to the disposition of strata, the conditions requisite for its success will be readily conceived; viz., watery strata connected with others on a higher level: the pressure of the water contained in the higher parts of such strata on that in the lower will readily force up the latter through any orifice, however small. All that is necessary, therefore, is to bore down to the stratum containing the water, and, having completed the bore, to insert a pipe, which may either be left to overflow into a cistern, or it may terminate in a pump. In many cases, water may be found in this way, and yet not in sufficient quantity and force to rise to the surface; in such cases a well may be sunk to a certain depth, and the auger-hole made, and the pipe inserted in it at the bottom of the well. From the bottom it may be pumped up to the surface by any of the usual modes."

WETHER. The castrated ram: it yields the best mutton, especially at three to five years old.

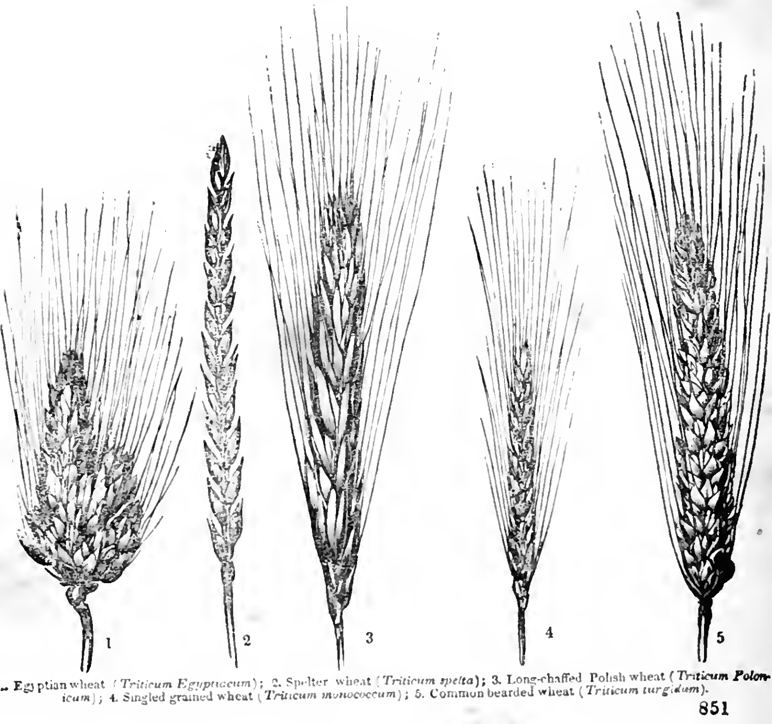
WHALEBONE SCRAPINGS. They form a manure very similar to woollen rags: half a ton is applied to the acre.

WHALE-OIL SOAP. A solution of this substance, at the rate of one pound in four or five gallons of water, is found the best application for destroying plant lice, whether on the stem or roots of trees. A weaker solution, sprinkled over vegetables attacked with lice, will also be found serviceable.

WHEAT. *Triticum hybernum.*

"Some botanists have divided wheats into different species, from some marked peculiarity in their formation. Others, considering that they mostly form hybrids when mixed in the sowing, and that their peculiarities vary with the soil and climate, have looked upon all the cultivated wheats as mere varieties. There are, however, three principal varieties, so different in appearance that they claim peculiar attention. These are the hard or flint wheats, the soft wheats, and the Polish wheats. The hard wheats are the produce of warm climates, such as Italy, Sicily, and Barbary. The soft wheats grow in the northern parts of Europe. The Polish wheats grow in the country from which they derive their name, and are also hard wheats. It is from their external form that they are distinguished from other wheats. The hard wheats have a compact seed nearly transparent, which, when bitten through, breaks short, and shows a very white flour within. The soft wheats have an opaque coat or skin, and which, when first reaped, give way readily to the pressure of the finger and thumb. These wheats require to be well dried and hardened before they can be conveniently ground into flour. The Polish wheat has a chaff which is much longer than the seed, a large, oblong, hard seed, and an ear cylindrical in appearance. It is a delicate spring wheat, and not very productive; hence it has only been occasionally cultivated by way of experiment.

"The following cuts represent



1. Egyptian wheat (*Triticum Egypticcum*); 2. Spelter wheat (*Triticum spelta*); 3. Long-chaffed Polish wheat (***Triticum Polonicum***); 4. Singled grained wheat (*Triticum monococcum*); 5. Common bearded wheat (*Triticum turgidum*).

some peculiar species of wheat. The first is a compound ear, produced by very luxuriant vegetation, and is common in Egypt. The second is the spelter wheat, of which the chaff is so strongly attached to the grain as to be separated only by passing through a mill. It is an inferior variety, but grows in less fertile soils. The third is the Polish wheat, with very long chaff and hard grains. The fourth is a variety which only ripens one seed in each spikelet, and is not much cultivated. The fifth is common soft-bearded wheat. If the awns of this kind are obliterated, it forms our common soft wheat. The existence of awns seems not to affect the nature of the wheat, and they differ so much in length that the varieties of smooth-eared and bearded wheats run insensibly into each other.

"The hard wheats contain much more *gluten*, a tough, viscid substance, which is very nutritious, and which, containing a portion of nitrogen, readily promotes that fermentation, or *rising*, as it is called, of the dough, which is essential to good, light bread. The soft wheats contain the greatest quantity of starch, which fits them for the vinous fermentation, by its conversion into sugar and alcohol; for brewing or distilling, therefore, the soft wheats are the best."

VARIETIES OF WHEAT.

White Flint.—This is one of the most valuable kinds in the Northern States. The heads are not long, but well filled, with thirty to forty grains; the kernel is white and flinty, large, and with thin bran. They are firmly attached to the chaff, and do not shell out except when very ripe. The heads are rather drooping, with few awns, the straw medium length, and very white and strong. The flour is very superior: the perfect wheat weighs from 63 to 67 pounds the bushel.

Harmon's White Flint.—A variety improved from the above, in which the berry is larger, bran very thin, and the flour equally good, if not superior: weighs 64 pounds the bushel. This and the above are little injured by the Hessian fly, and will stand a good deal of wet weather without injury.

White Provence.—Heads middling and bald; chaff bluish; berry large and white; bran thin; flour good. It is early, but the straw is small, long, and soft, and very liable to fall.

Old Red Chaff.—An old and favourite kind, but now liable to rust and the fly. Red chaff, bald; long straw; berry white, large, weighing 62 pounds the bushel; bran thin; superior flour.

Kentucky White-bearded, Canada Flint.—White chaff, bearded; heads short and heavy, well filled; shells readily; berries round, short, and white; weighs 60 to 65 pounds the bushel; flour very good, but not equal to the white flint. It tillers little; the straw is strong, but liable to injury from insects.

Indiana Wheat.—White chaff, bald; berry white and large; bran thin; the berry not as flinty as the white flint, some of the best quality weighing sixty-four pounds to the bushel, producing flour of superior quality and quantity; straw is larger and longer than the white flint; shells easily, so that there is considerable loss if it remains in the field till fully ripe. Insects have attacked it more than the flint, and it is more liable to be winter-killed.

A variety of white wheat is much esteemed in western New-York, which resembles an improved Indiana. It is called *Scotch wheat*.

Virginia White May.—It has a white chaff, bald, much resembling the white flint in its growth and straw; the heads are more clumped; the berry standing out more, and shells easier. The berry is white, with a very hard and flinty appearance, weighing from 63 to 66 pounds to the bushel; bran of a medium thickness, producing flour of a good quality. Its early maturity makes it valuable.

Wheatland Red.—This is a new variety which originated with General Harmon, from the Virginia May. It has a red chaff, bald; heads of medium length, and well filled with a red berry, weighing 66 pounds to the bushel, and producing flour of good quality. This is a very hardy variety; straw of good size, and very bright; it has the quality of the Virginia May in its early ripening.

Red Bearded.—Red chaff, bearded; beards standing out from the head; berry white, weighing from 60 to 62 pounds the bushel; yields flour well, and of good quality; this is a hardy variety; succeeds well after corn, or on light soils. Straw not large or very stiff. This variety would be more extensively cultivated if its beard were not objectionable.

Mediterranean.—This was introduced into Maryland from the Mediterranean Sea. It is a light red chaff, bearded; berry red and long; very flinty; bran thick, producing flour of an inferior quality. This variety may prove valuable at the South, being seldom affected with the fly, and its early ripening is favourable on account of rust. Its long, stiff beards, heads short, shelling very easy (so much so, that if it is not cut while in its doughy state, there will be a great loss), and the inferior quality of its flour, are strong objections to its culture, where wheat of superior quality succeeds well.

Blue Stem.—Has been cultivated in Virginia for about thirty years; white chaff, bald; berry white; weighs 64 pounds to the bushel; bran thin; produces flour of superior quality. Formerly this was a red wheat, now it is changed to a beautiful white. Straw fair size, producing well. It is now one of the most productive varieties cultivated in Virginia.

Besides these well-known varieties of winter wheats, several are of local reputation and worthy of trial. Some, as the Valparaiso and Humes's white, are of great promise, but remain to be fully tested. The choice English varieties, as the Talavera, golden drop, are found too tender for our severe winters in New-York.

Of *spring* wheats, the *Tea*, or *Siberian, bald*, and *Black Sea* are the best. The *Italian spring*, formerly in great demand, has much degenerated.

"The distinction between the winter and summer wheats is one which arises entirely from the season in which they have been usually sown; for they can readily be converted into each other by sowing earlier or later, and gradually accelerating or retarding their growth. The difference in colour between red and white wheats is owing chiefly to the soil; white wheats gradually become darker, and ultimately red in some stiff, wet soils, and the red wheats lose their colour and become first yellow and then white on rich, light, and mellow soils. It is remarkable that the grain sooner changes colour than the chaff and straw: hence we have red wheats with white chaff, and white wheats with red chaff, which on the foregoing principle is readily accounted for. The chaff retains the original colour when the skin of the grain has already changed to another. We state this on our own experience. The soil best adapted to the growth of wheat is a deep loam inclined to clay with a dry subsoil. If this is not so naturally, it must be drained artificially, to ensure good crops of wheat. In such a soil, wheat may be sown every third year, with proper intermediate crops. Formerly, the preparation for a wheat crop was generally by a clean, naked fallow, with a certain addition of manure, the remains of which were thought sufficient for a crop of barley or oats; after which the fallow recurred. It was soon found out that, by this means, a crop of wheat could never be forced beyond a certain average; for if more than the usual portion of manure was carried on the land, the wheat failed, by being laid before it arrived at maturity. Thus a limit appeared to have been set to its increase. New modes of cultivation have shown that this was not without its remedy, and that it was recent manuring which caused the wheat to lodge; but that an increased fertility, produced by judicious preparation, enabled the land to bear crops of wheat far superior to what it ever could before. Wheat requires a soil in which the organic matter is intimately mixed with the earthy ingredients, where it can have a firmer hold by its roots, and can at the same time strike the fibres of them downward as well as around, in search of food. When it meets with such a soil, and is deposited at a proper depth, it vegetates slowly, pushing to the surface one cylindrical filament, while numerous fibres strike into the soil from the seed. These supply the plant with regular nourishment, and in due time a knot is formed at the surface of the soil, from which several roots and stems branch out. This is called the tillering of the wheat. The new roots near the surface soon become the chief source of nourishment, and in a rich, compact soil, where there is room, numerous stems arise, forming a tuft, and each of these in time bears a large ear well filled with seeds; so that, from a very moderate quantity of seed, a great return is produced. The strong stems supporting each other are well able to resist the effect of storms and rains, which would lay weaker plants level with the ground. The effect of abundant manuring immediately before the seed is to produce too rapid a growth, weakening the straw, and increasing its quantity at the expense of the ear, which does not attain its proper development. This is called running to straw. All strong manures, which contain many azotized particles, have this effect, which is corroborated by late experiments with saltpetre and nitrate of soda. They produce more straw and less corn, and hence are not found of the same use, when applied to crops which are cultivated for their seed, as they are on grasses.

"Decayed vegetable matter, or humus, seems essential in a good wheat soil; and it may, in the slow progress of its entire decomposition, when it is continually absorbing the oxygen of the air, have some chemical effect on the nitrogen also, so as to make it of use in the vegetation, whether by first forming ammonia, or in any other way. Farther experiments may, perhaps, throw a light on this subject. It is well known, however, that, provided a soil be compact, its fertility is very nearly proportioned to the quantity of humus which it contains, especially if there be calcareous earth or carbonate of lime in its composition. Lime has been often considered as the most efficacious manure for wheat, even more than dung. As long as there is organic matter in the soil lime acts beneficially; and the richer the land which does not contain carbonate of lime already, the more powerful the effect of liming. But experience has proved that lime has little effect on poor soils in wheat, until they are first manured with animal and vegetable substances. To produce good wheat, then, the land should be gradually brought to the proper degree of fertility, by abundant manuring, for preparatory crops, which will not suffer from an over-dose of dung, and will leave in the soil a sufficient quantity of humus, intimately blended with it, for a crop of wheat. Clover is a plant which will bear a considerable forcing, and so are beans, and both are an excellent preparation for wheat. The roots left in the ground from a good crop of either decay slowly, and thus furnish a regular supply of food for the wheat sown in the next season. Potatoes, also, admit of much forcing, but the necessary loosening of the soil for this crop renders it less fit as a preparation for wheat. Experience has fully proved that, as a general rule, it is better to sow barley and clover after potatoes, and let the latter be succeeded by wheat.

"Improved chemical analysis has discovered various substances in minute quantities in the grains and straw of wheat; and this has led to the doctrine that these substances, being essential to its formation, must be excellent manures for it, if they do not already exist in the soil in sufficient quantities. Most of these substances are found in all soils which contain a due proportion of clay. Silica, in a very minutely-divided state, and probably in combination with soda or potass, seems one of the most important to give due strength to the straw; and hence, in some soils, potashes or wood-ashes which contain it may be advantageously used as manures to the wheat. The analysis of the ashes of grains of wheat chosen out of the ears, by Theodore de Saussure, gives the following results:

Potass	15
Phosphate of potass	32
Muriate of potass	0·16
Sulphate of potass	a trace.
Earthy phosphates	44·5
Silica	0·5
Metallic oxides	0·25
Loss	7·59
	100·

"The analysis of the ashes of the straw gave the following results:

Potass	12·5
Phosphate of potass	5
Muriate of potass	3
Sulphate of potass	2
Earthy phosphates	6·2
Earthy carbonates	1
Silica	61·5
Metallic oxides	1
Loss	7·8
	100·

"The analysis of the ashes of the whole plant, when in blossom, gives of

Soluble salts	41
Earthy phosphates	10·75
Earthy carbonates	0·25
Silica	26
Metallic oxides	0·5
Loss	21·5
	100·

"By comparing these results, it will appear that, from the time of flowering to the maturity of the seed, a portion of the soluble salts is replaced by earthy phosphates; that silica accumulates in the straw, but not in the grain; and as potass is the principal means of rendering the silica soluble, it is an important ingredient in a wheat soil, as well as the phosphoric acid. This last is found chiefly in bone earth and animal manures.

"Although wheat thrives best on heavy soils, and, without due preparation, produces only scanty and uncertain crops in those which are naturally light and loose, it may be made to give a very good return in soils which would once have been thought fitted only for the growth of rye and oats; but then the texture and composition of these soils must have been greatly improved by judicious tillage and manuring. While the heavy soils are repeatedly ploughed and pulverized to render them mellow, the lighter are rendered more compact by marling, where this can be readily done, by adding composts in which the principal earth is clay, and especially by such plants as have substantial and long roots, by which the soil is kept together, such as clover, lucern, sainfoin, and other grasses. If these plants have been well manured, and cover the ground well, keeping in the moisture, the soil will have become sufficiently compact to bear wheat. One ploughing is then quite sufficient; and if a heavy land-presser is made to follow two ploughs and press in the furrows, so as to leave deep, smooth drills, eight or nine inches apart, in which the seed can find a solid bed, there will be every probability of a good crop of wheat, which will come up in regular rows, the roots being at such a depth as to run no risk of wanting moisture till the stem has arisen to its full height and the ear is formed; a few showers at that critical time will make the grain swell, and ensure a good crop.

"On some soils it may not be judicious to attempt to sow wheat; but these are the poorest loose sands, which naturally would bear only oats and buckwheat; on these, unless they can be abundantly marled, it is much better to sow rye. When wheat is sown on light soils in good heart, it grows vigorously in spring, if it has not been injured by the frost, which is very apt to raise up the roots and throw them out of the ground. The driving of sheep over the field presses the roots into the ground, and prevents this throwing out; but a vigorous growth of straw is not always a sure sign of a good crop at harvest, as many farmers know by sad experience; what would be advisable in heavy soils is not always so in lighter. A heavy rolling in spring after a light harrowing is very useful at a time when the surface is moist. It closes the pores and checks the evaporation; and the tighter the surface can be made, the better chance there is of a fair crop. The Norfolk rotation, as it is generally called, in which wheat is sown after clover, is the only one well adapted for wheat on light soils. The manure having been put abundantly for the turnips or roots, and the land being freed from weeds, the barley which follows is generally a good crop; and the clover, which is sown in this, is trodden in the reaping and carrying of the barley; and there is only one ploughing from the time the barley is sown to the sowing of the wheat. If this be dibbled on the turned sward of the clover, the land will receive another treading by the dibblers, the seed will be regularly deposited at a proper depth, and no preparation of light land can be more likely to produce good wheat. On heavy soils the process must be varied; the surface, instead of being rendered more compact, will often be so bound as to require to be stirred by harrowing or hoeing before the wheat plant can properly tiller. If a farmer is anxious to have good crops of wheat, he must not rest satisfied after he has ploughed, manured, and sown; he must watch the growth of this important crop daily, and use the means which experience and observation have suggested to assist the growth and to remove the causes of failure.

"In heavy soils nothing is more detrimental than excess of moisture. Even in well-drained fields the water will stand too long in the furrows if there is not a proper outlet for it. The furrows should be well cleared out with the spade as soon as the seed is sown, drilled, or dibbled, the earth being thrown evenly over the surface of the stitches, and not left in an unsightly ridge, which crumbles down with the furrow at the first frost. In proper places and at regular distances, deeper water-furrows should be dug out after the plough has ploughed a deep furrow in the intended line; and this should then be finished as is said above; so that if a heavy fall of rain should come suddenly, the water will have a regular course and outlet into the ditches which lie in the lowest part of the land, without soaking into the soil, which is already too retentive of moisture. It is chiefly in spring and when snow melts that there should be a daily inspection of the wheat-fields. An experienced eye, going along the bottom of the ridges of a large field, will discover at once whether there is any stoppage of the water; and by means of a spade or shovel it will be remedied with little trouble. When the surface binds, as it does in some soils, and prevents the access of air to the roots, the land is harrowed, and in a few days the effect will be apparent.

"Soils which lie on a very porous subsoil, or which, by artificial draining, have been so dried and mellowed that horses can go over the land at all times without making such an impression as will retain water if it rains, may be laid flat, without more open furrows than are necessary for the convenience of ploughing with a fixed turn-furrow; and thus a considerable portion is made productive which would be taken up by furrows, and, perhaps, produce weeds. But if the soil is of a tenacious quality, easily compressed when moist, and horses cannot safely be allowed to pass over it when wet, it is absolutely necessary to divide the land into stitches, or beds with furrows between them, in which the horses can walk while they draw harrows or any other implement over the land. All the implements should be so constructed that, if they have wheels, these may run in the furrows, so that nothing will disturb the evenness of the stitches, which should have a gentle slope from the centre towards the two furrows which bound it. For spring crops this is not so essential, although it is advisable not to deviate from the usual form, even when barley and clover are sown; because, when the surface is laid in double stitches, as is sometimes done, it is not very easy to lay it in narrow stitches again, at one ploughing, for wheat. No doubt a very expert ploughman would do so, but it is not often that many expert ploughmen are on the same farm. Even in very light soils, as in Flanders, narrow stitches with deep intervals are thought most advantageous.

"It is a very common notion that good wheat and bean land is not well adapted to the growth of roots, especially of such as are usually fed off the land by sheep, because the treading of animals is injurious in winter and spring, when these crops are usually wanted; and if they are carted off, the wheels and the horses make such impressions as are equally detrimental, or more so. But all roots, even the white turnip, will grow luxuriantly on heavy soils, well prepared and manured; and they may be so managed as to be taken off before the winter. The bulbs will not be so large, but they will be more succulent, and may be kept in various ways till they are wanted for the cattle. The land, being ploughed immediately on the removal of the roots, will be well prepared for wheat, or, when mellowed by the winter's frost, may be sown in spring with beans, barley, or oats. The manure will be incorporated with the soil, even if it has been put on in a very fresh state for the roots, which can only be recommended on very compact soils. If the root crops are well cleaned, fallows may be avoided, or, at least, recur very seldom, and then only when weeds have accumulated from neglect.

"When the wheat has blossomed, and the grain in the ear is fully formed, it should be watched, and as soon as the seed feels of the consistence of tough dough, and the straw is dry and yellow below the ear, it should be reaped. The skin of the grain will be thinner, and its substance will harden readily, by mere drying, while the straw is better fodder for the cattle. It is found by experience that the increase of flour by adopting this method is very considerable.

"It was the custom of our forefathers to cut the straw half way between the ear and the ground; and their reason was, that thus less room was required in the barn, and no seeds of weeds were carried there in the straw; but the loss of half the straw, which might have afforded litter or fodder for cattle, was overlooked: and if the weeds were not taken into the barn, where they could do little harm, except giving a little more trouble in winnowing and sifting the corn, they were left to shed their seeds on the land, and thus perpetuate its foulness, or add much to the labour of weeding the succeeding crops. The stubble or haulms had to be mown or raked off before the land could be well ploughed; and, although this might make a very good shelter for cattle in a yard, when made into haulm-walls, as they are sometimes called, there was a great loss of labour in thus going twice over the field. The most approved mode of reaping now is that which is called fagging or bagging (see *Harvest*); but the most expeditious is mowing, which, by means of a cradle scythe, may be done so regularly as to allow all the corn to be tied up in sheaves without any loss. The weeds are tied up with the corn, and when the whole is thrashed, the seeds of the latter are winnowed out and burned; thus they cannot infest the land, and there is double the quantity of straw to convert into manure: a matter of great importance where cattle are fed on turnips in the yard, chiefly for the sake of their dung.

"The choosing of wheat for seed is a matter of great importance. Some farmers like to change their seed often; others sow the produce of their own land continually, and both seem persuaded that their method is the best. The fact is, that it is not always the finest wheat which makes the best seed; but it depends on the nature of the land on which it grew. Some soils are renowned far and wide for producing good seed, and it is well known that this seed degenerates in other soils, so that the original soil is resorted to for fresh seed. Many places have been noted for this peculiarity, and among them we may mention Genesee, New-York; the wheat which grows there is sold for seed at a price considerably above the average. It has been asserted of late, and we have no reason to doubt the assertion, that the various noted seed-wheats, when analyzed, are found to contain the different elements of which they are composed in nearly the same proportion, especially the starch and gluten. For bread, that which contains most gluten is preferred, as we observed before; but to produce a perfect vegetation there should be no excess of this substance, nor any deficiency. The seed, also, should have come to perfect maturity. This last is usually obtained by beating the sheaves over a block of wood or a cask, without untying them, by which means the ripest seeds fall out. The proportion between the starch and gluten is easily ascertained by carefully washing the flour when the wheat has been ground. It is most convenient to tie up the flour in a cloth, which, shaken and beaten in water, will let all the starch pass through, and retain only the gluten. The operation should be continued as long as the water is tinged with the white starch. Any one can readily make the experiment; and as soft wheats vary much in the proportion of the gluten they contain, the difference will be readily ascertained. This leads to a practical conclusion: if we wish to grow any peculiar sort of wheat for seed, and if we find that, by our preparation of the soil, or its original composition, we produce a wheat in which the gluten and starch are in a different proportion from that of the original seed, we may conclude that this is owing to more or less animal or vegetable manure in the soil; and by increasing the one or the other, we may bring our wheat to have all the properties of the original seed. This is a valuable discovery, and deserves to be fully confirmed by experience. The gluten varies from 10 to 35 per cent.

"*Diseases.*—While the wheat is growing, it is exposed to various accidents, which it is often difficult to foresee, and more difficult to guard against. The smut and burned ear are diseases which may be generally prevented by a proper preparation of the seed before it is sown. (See *Smut.*) Many corrosive substances have been recommended to steep the seed in, such as blue vitriol and arsenic, and those who have used these steeps place great confidence in them. It seems, however, that washing the seed well with plain water, or with salt and water, and afterward drying it with quicklime, sufficiently destroys the germ of the smut to prevent its propagation. The most common steep is water in which so much salt has been dissolved as will enable it to float an egg. In this the seed may be left for twelve hours or more, and then spread on a floor, and mixed with as much quicklime as will absorb the moisture, and allow it to be sown or drilled, without the grains adhering to one another.

"In the second volume of the 'Journal of the Royal Society of Agriculture of England,' Part I., is a valuable paper, by the Rev. T. S. Henslow, on the diseases of wheat. He describes the different *fungi* which produce the various diseases of pepper brand, dust brand, rust, and mildew; he doubts the truth of the assertion that Berbery trees or bushes cause mildew in wheat which grows near them, although this is believed by many farmers.

"The ergot in wheat is an excrescence from the ear, like a small horn, into which the seed is transformed. It has a poisonous quality, and is medicinal. See *Ergot.*

"Another disease of the seed is called ear-cockles, and is caused by extremely minute insects, like eels, which fill the skin of the seeds instead of flour. This insect, which is called *Vibrio tritici*, is described by Mr. Bauer in the 'Philosophical Transactions' for 1823. This disease is not so common as the smut and pepper brand. It is probable, according to Mr. Henslow, that the animalcules may be killed by exposing the grain to a certain heat, so as not to destroy its power of vegetation, but sufficient to kill the vibrio."

The *chinck* bug, in the Southern States, is often more destructive than the Hessian fly.

"Great attention has been lately paid to the introduction of the best and most prolific varieties of wheat, and by merely observing what ears appear much superior to others in a field of ripe wheat, and collecting these to be sown separately in a garden or portion of a field, the variety, which may have been produced by some fortuitous impregnation, or some peculiarity in the spot where it grew, is perpetuated. By carefully selecting the seed which is best adapted to the soil, by a more careful and garden-like cultivation, and by adding those manures which are found most adapted to favour its perfect vegetation, crops of wheat have been raised which, at one time, would have been thought miraculous."

WHEAT, CULTIVATION IN WESTERN NEW-YORK. The following, from General Harmon, is worthy of great attention from its practical value:

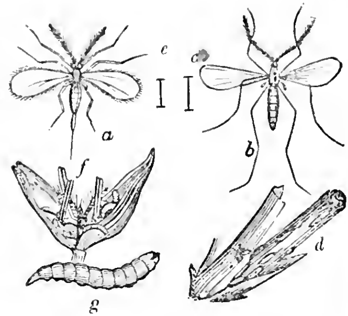
"The soil that I have under cultivation is probably as well adapted to the producing of as fine a quality of wheat as any in the world. It is a gravelly loam, with limestone of small size gravel up to several pounds each. It is what has been called the hard oak openings. My rotation is of three years shift. Clover is invariably sown on wheat in March or April, about eight pounds to the acre; and as soon as the ground is dry in April, sow one bushel of plaster to the acre. The next year pasture or mow; the third year, in June, plough seven or eight inches deep. The clover should be mostly eaten off when ploughed. The turning under of a great growth of clover I believe to be injurious to the next crop of wheat. If fed off with sheep, the manure they drop is worth more to the wheat crop than if it had been turned under in its green state. In turning under green clover, there is in the next crop frequently a coarseness in the leaf and straw that is not favourable to the production of a fine quality. I go over the ground thus ploughed with the cultivator harrow three or four times by the first of September; then cross-plough, and sow on the furrow from the 10th to the 15th of the month; then harrow it in with the cultivator harrow. It buries the wheat deeper than the common harrow, giving the plant a more vigorous appearance, and rendering it less liable to injury by the thawing and freezing in March and April. Wheat, for seed, should be selected from that part of the field that is first ripe and where it ripens evenly. All lodged or rusty straw should be rejected, for wheat from such straw does not fully mature. It will grow as soon as any other, but wheat of superior quality is seldom obtained from such seed. All small or imperfect kernels should be sifted out, and nothing but the pure seed sown. Twenty-four hours before the wheat is sown it should be washed in a brine as strong as salt will make it. After draining a few minutes, mix with each bushel two quarts of newly-slacked lime, and then sow one and one fourth bushels to the acre. The above is my course of operation. My average crop for several years past has been over 20 bushels per acre, of very superior quality, mostly sold for seed; the past season over 1100 bushels. My price has uniformly been twenty-five cents over the millers. One great difficulty in the way of farmers improving their wheat crops is, the sowing of poor grain mixed with other seeds, and believing that Wheat turns to chess. While at the State Fair, at Poughkeepsie, last fall, I saw several barrels of wheat, of different varieties, all mixed with so much cockle and chess, that a Wheatland miller would not take such for flouring as first quality. The man that had it said it was sent to him from Western New-York for seed, and he was trying to sell it as such. As long as such seed is sown, we shall have those farmers that believe wheat will degenerate into chess. In selecting the best winter variety, I will name the ones that I believe will do best on the different soils where wheat is sown. There are some varieties that succeed better on some soils than others. If the soil is rich clay loam, it is important to sow a small and early variety: the Kentucky white, better known as Hutchinson wheat; Mediterranean; or Wheatland red. If sandy, gravelly loam, the improved white Flint, old Genesee red, Chaff bald, Saul's wheat, and Flint. In selecting the variety that will do best on all soils, I am confident the improved white Flint stands first for the quantity and superior quality, producing more flour of superior quality than any other of nearly forty different varieties that I have had under cultivation. I know of no spring variety that will come up to the winter where they succeed well. In some sections of country none but spring varieties will succeed. The Black Sea red, Chaff bearded, are the hardiest and most productive of any of the spring varieties of good quality. The Tea wheat is a very beautiful spring wheat, white, chaff bald, berry white. It is not as productive as the Black Sea; the quality is superior."

WHEAT, COW. See *Cow Wheat.*

WHEAT GRASSES. Grasses of the same genus as wheat (*Triticum*), of which the couch grass (*T. repens*) is best known. They are not indigenous in the United States, and, although very nutritious, are not objects of special cultivation.

WHEAT, INSECTS OF. The two most severe enemies are species of *Cecidomyia*, a genus resembling the gnat.

The *Hessian fly* (*C. destructor*), *Fig.*, *b*, is represented of the natural size at *c*; it has a black head, thorax, and wings, with a brownish body. Two generations appear in the year: the first in spring, the second in Septem-



ber and October. The females lay their eggs on the young shoots of spring or fall wheat. The worm, which is hatched in a few days, descends to the lower parts of the stem near the earth, where they become changed into grubs of the size and appearance of a flaxseed (*d*); here the winter generation remain, and are converted into winged insects in spring. They destroy the plant by sucking its juices, and hinder the development of flower stems. The most effective means to avoid this fly is by selecting wheat with a tough straw, as the Mediterranean, by sowing early, and preparing the ground and seed, so as to give it a good start. Scattering lime, and using nutritious manures, such as guano, early in the spring, may do good. Close feeding by sheep is also adopted where the grubs are found early. Burning the infected straw is a preventive. The Hessian fly is attacked by ichneumon flies, which deposite their eggs in the body of the grub.

The *wheat midge*, or *fly* (*C. tritici*), *Fig.*, *a*, has been of late a severe pest in the Northern and Eastern States. It is smaller (*c*) than the Hessian fly, of a yellow colour, with clear wings. They are seen in June, when the wheat is in flower, and the eggs are deposited during dusk in the scales of the chaff. The maggots (*f*) are of a yellow colour, changing to brown, and eat the young seed as it is formed. *g* represents one of the worms magnified. The maggots fall to the ground to change into chrysales, and are protected in the soil until the next season, when they come forth in spring.

Fumigations with sulphur and smoke have been tried during the evening to destroy the worms; the success is, however, only partial. Sprinkling lime and ashes is much better: a mixture of half a bushel of each may be used to the acre. The lime should be water-slacked. After an invasion of these destructive insects, the stubble should be burned, the soil ploughed deep, and no wheat sown for one or more seasons. Early or late sowing will do little towards saving a crop of wheat, for it appears that the midge lives for thirty-nine days.

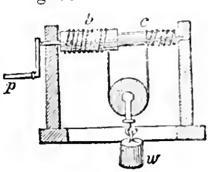
The English papers mention another insect, the *Ascius pumilarius*, which attacks wheat in the same way as the Hessian fly.

In Virginia, and some other Southern States, the *chinck bug* is often destructive. See that insect.

The wheat weevils found in the United States are the *Calandra* (*Curculio*) *granaria* and *oryzæ;* they are both readily destroyed by kiln-drying, at 150° to 180° Fahr. A figure of the former will be found in the article on insects.

Besides these, other insects are occasionally found in smaller quantities, preying on the roots and young stem, but they seldom produce the destruction of the crop.

WHEEL and AXLE. A common mechanical contrivance for raising weights, especially water from wells; the advantage is increased by enlarging the wheel and diminishing the axle, but always with a loss of time. The best form for great mechanical advantage is that represented in the figure.



WHEELBARROW. A light carriage driven by a man and moving on one wheel. It is made of stout plank for carrying stone and earth, and is lighter and larger for the transportation of grain.

WHEEL PLOUGH. A plough with a wheel in the heel to diminish the friction of the sole. See *Plough.*

WHEELS OF CARRIAGES. The wheel consists of three parts: the nave, centre, or hub; the spokes; and the circumference, or felloes, bounded with its iron tire. The materials may be of iron or wood; if the latter, elm or white oak is preferred for the nave, white oak for the spokes, and ash for the felloes. The centre of the nave is furnished with an iron box to receive the axletree. The wood should be thoroughly seasoned, and the framing of the wheel set together some weeks before the tire is put on. The manner of setting the tire is well known: it is heated in a brush fire until nearly red hot, and then placed over the felloes and at once chilled with water. It should be so set as to allow the nails used to fasten it to be driven into the spokes. Great improvements have been made in the axle, which is enclosed in iron or of wrought iron: the latest improvement is that of surrounding it with a system of friction wheels, which lie between the box and axle, and reduce the friction to a minimum.

The advantage of the wheel is two-fold. "In the first place, they greatly diminish the friction on the ground by transferring it from the circumference to the nave and axle; and in the second place, they serve to raise the carriage more easily over obstacles and asperities met with on the roads. The friction is diminished in the proportion of the circumference of the axle to that of the wheel; and hence the larger the wheel, and the smaller the axle, the less is the friction. Large wheels are, therefore, best adapted for surmounting inequalities of the road. There are, however, circumstances which prescribe limits to the height of the wheels of carriages. If the radius exceeds the height of that part of the horse to which the traces are attached, the line of traction will be inclined to the horizon, and part of the power will be exerted in pressing the wheel against the ground. The best average size of wheels is considered to be about six feet in diameter. The fore wheels of carriages and wagons in this country are usually much too small.

"Cylindrical wheels are best adapted for level roads; and the breadth of the rim should be considerable (not less than three inches), to prevent their sinking into the ground. In hilly and uneven roads a slight inclination of the spokes, called *dishing*, tends to give strength to the wheel; but it is very frequently carried to excess."

"Carriages with four wheels are much more advantageous than carriages with two wheels, as carts; for with two wheels, it is plain the tiller horse carries part of the weight in one way or other; in going down hill the weight bears upon the horse, and in going up hill the weight falls the other way and lifts the horse, which is still worse. Besides, as the wheels sink into the holes in the roads, sometimes on one side, sometimes on the other, the shafts strike against the horse's sides, which destroys many animals; moreover, when one of the wheels sinks into a hole or rut, half the weight falls that way, which endangers the overturning of the carriage."

Mr. Scripture, of New-York, has recently patented a carriage wheel which promises well. It is furnished with two separate hubs, which can be screwed together; by this means the pressure of the spokes on the felloes and tire is easily regulated, and the tire can neither become bound nor so loose as to want cutting.

WHEEL-SHAPED COROLLA. A rotate corolla: it is monopetalous, with a spreading border and very short tube.

WHEEL WORK. A combination of wheels for the purpose of increasing speed or gaining power. Motion is communicated from the circumference of one wheel to the axis or pinion of another by teeth, belts, or occasionally by friction. The teeth of all the wheels and pinions in the work must be of the same size; they should also be smooth on their surfaces, and curved gradually to the summit to diminish friction. "Toothed wheels are of three kinds: *spur wheels*, *crown wheels*, and *bevelled wheels*. When the teeth are raised upon the edge of the wheel, or are perpendicular to the axis, the wheel is a spur wheel; when they are raised parallel to the axis, or perpendicular to the plane of the wheel, it is a crown wheel; and when they are raised on a surface inclined to the plane of the wheel, it is called a bevelled wheel. The combination of a crown wheel, with a spur wheel as pinion, is used when it is required to communicate motion round one axis to another at right angles to it."

WHEEZING IN HORSES. Broken wind.

WHELP. The young of the dog.

WHETHERING. Retention of the after-birth in cows. It should be removed by hand if retained too long, as the decomposition of the substance will otherwise destroy the animal.

WHETSTONE. A silicious slate used for whetting implements.

WHEY. The watery parts of milk containing the sugar of milk, with a little casein and saline matters. It is fermentable, and made by some of the Asiatics into an intoxicating drink. In the dairy there are two kinds of whey; that which is clear and separates from the milk when rennet is added, and that which is pressed out from the curd. The latter is white, and used to make whey butter or cottage cheese. See *Butter*. Whey is used for feeding hogs, and given in Scotland even to horses.

WHEY BUTTER. See *Butter*.

WHIN. Gorse. See *Furze*.

WHINSTONE. A kind of basalt.

WHIP GRAFTING. Tongue grafting. See *Grafting*.

WHIPPING OUT GRAIN. Striking the ears against a stone or the edge of a board till the corn is separated from the straw.

WHIPPLE-TREE. A swinging tree. The bar to which the traces of the horse are fastened.

WHIRLBONE. The knee pan. In the horse, the articulation of the thigh bone in the pelvis; the acetabulum.

WHIRLWIND. A revolving wind, blowing to a centre. The tornado is a violent whirlwind.

WHISKEY. A strong spirit distilled from the fermented mash of corn, barley, wheat, or other grains.

WHITE ARSENIC. Common arsenic, arsenious acid. It has been recommended for dusting grain after brining, but should never be used; for other substances, as blue vitriol, answer muchbetter, and are not so dangerous.

WHITE CEDAR. See *Cedar.*

WHITE CROPS. Grain crops; the *Cerealia.* They are exhausting, from the quantity of seed they form, and are foul crops, from allowing weeds to grow among them. White crops require to be followed by clean crops, and should be preceded by root crops, as far as practicable.

WHITE-LEAD. Carbonate of lead, a valuable pigment, but liable to adulteration with sulphate of barytes. This is detected by mixing a sample with dilute nitric acid, which will dissolve all the true white-lead and leave the barytes. It is the basis of all colours used in common painting.

WHITE PRECIPITATE. A violent mercurial poison, used in ointments for destroying vermin.

WHITE ROOT. *Asclepias tuberosa.* Colic or pleurisy root; butterfly weed. It is used in domestic practice as a cathartic, diaphoretic, and expectorant.

WHITE SCOUR. Diarrhœa.

WHITE THORN. The hawthorn.

WHITE TOP. *Agrostis alba.* A grass very similar to red top.

WHITE SWELLING. An indolent, scrofulous tumour, usually situated near the joints. It is very difficult to manage.

WHITE VITRIOL. Sulphate of zinc. It is a powerful emetic, and is also used in lotions.

WHITEWASH. A wash of milk of lime with size, to enable it to adhere. Whitewashing not only improves the appearance of wood-work, but protects it from the weather and insects. It is a good means of purifying rooms in which substances of a bad odour have been stored.

WHITE WEED. The larger perennial May weed (*Chrysanthemum*), occurring in wheat fields and meadows.

WHITE WOOD. The tulip-tree.

WHITING. Prepared chalk, for cleaning brasses and silver.

WHITLOW. A painful inflammation near the bone, tending to suppuration.

WHITLOW GRASS. The genus *Draba:* cruciferous plants, some of which are ornamental.

WHORL. In botany, an arrangement of leaves or other organs around the stem, and apparently on the same level, as the leaves of madder.

WHORTLEBERRY. The genus *Vaccinium*, yielding the berries called bilberries, huckleberries, and whortleberries. The plants are small shrubs, often evergreen, and growing in rocky wastes or boggy places. The leaves contain much tannin, and turn red when dead. They are readily propagated by root suckers, by root or stem cuttings, or seed.

WICKET GATE. A small, light gate for the passage of men and horses only, and not for wagons.

WILD INDIGO. *Baptisia tinctoria.* A perennial leguminous plant, with wedge-ovate leaves, and yellow terminal racemes, flowering in July. It grows three feet high, is common in the woods throughout the States, and affords a good amount of indigo dye.

WILDING. Young trees produced from seeds naturally distributed.

WILD PEAR. The June berry.

WILD RICE. *Zizania aquatica.* Water oats. See *Rice, wild.*

WILLOW. The genus *Salix*, containing thirty-five species indigenous to the United States. They are amentaceous and diœcious trees and shrubs, growing for the most part in swampy lands. The genus includes large trees, as the *S. Babylonica*, weeping-willow, and some shrubs of only a few inches height. The light and elegant appearance of many species have introduced them into shrubberies and parks, as the *S. vitellina*, yellow willow; *S. alba*, white willow; *S. Russelliana*, the Leicester or Bedford willow: the last is also valuable for timber, the tannin of its bark, and the proportion of *salicine* it contains, and is therefore extensively cultivated in England.

The wood of most of our willows is of no service except for charcoal, and of this they produce a kind preferred for the manufacture of gunpowder. The commonest species are *S. nigra*, the root of which is very bitter, and used as a domestic medicine; *S. lucida*, or shining willow, the twigs of which are used for coarse baskets. The bark of some kinds is used for domestic dyeing, and produces a yellowish red colour. In the north of Europe the *S. alba* is put to a variety of purposes: the bark is employed for tanning and dyeing, and the leaves and young shoots used as fodder, both in the fresh and dried state. See *Osier*, for basket willows; also *Sallow*. Nearly all the species are readily propagated by cuttings placed in a moist soil or well watered.

WILLOW HERB. The genus *Epilobium*, perennial herbs, growing in wet soils: a few are cultivated for their flowers.

WILLOW LICE. Aphidians, plant lice.

WILLOW WEED. An annual weed, *Polygonum lapathifolium*, growing in wet, light, arable lands. The seed resembles a small buckwheat; they are relished by birds and hogs.

WINCH. A bent or rectangular handle for turning an axis, attached to grindstones, the windlass, and other machines.

WIND. The motion of large portions of atmospheric air. It occurs with a velocity differing from a few miles to sixty or more miles the minute. The origin of winds is usually referred to the unequal temperature imparted to the earth's surface by the sun; this not only varies with the latitude, but with the elevation, geological character, and extent of water, and, secondly, to the sudden condensation of large quantities of its vapour. The excess in expansion of the air produced at any place causes an upward current, which affects the bulk of air lying around, and generates a motion from all points to the centre. In seeking the centre, the motion is spiral or centripetal, according to the best theories. Winds are of interest to the farmer from the meteoric effects they produce, as rain, snow, frost, increase of the drying power, and hail. A body of air in motion increases the evaporation of water from the land and plants even to double the extent of the ordinary action at the same temperature; this increases their coldness, and may produce frost even during a mild season; in hot, dry weather, plants wither more rapidly during windy weather. For this reason, tender plants require shelter from rough winds. The character of any wind is dependant upon the country over which it passes; those which sweep over hundreds of miles of the sea or lakes are usually surcharged with moisture, and produce rain if they pass into a northern region, as in the case of our southwestern storms. Winds which sweep over hot, dry deserts become simooms; their contact withers vegetation in a few minutes. So winds produce coldness which come from snowy districts, and warmth when they come from the south. The study of the peculiarities of every wind, and the season of its prevalence, is to the farmer one of the most important objects, and, taken in connexion with the fluctuations of the barometer and thermometer, will after a time enable him to foretell rain for many hours before its appearance.

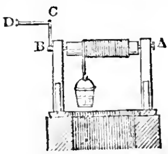
WIND FLOWER. *Anemone Virginiana.* A wood flower.

WIND GAUGE. See *Anemometer.*

WIND IN HORSES. Respiration. See *Broken Wind.*

WIND GALLS. Small tumours near the fetlocks of horses, produced by strains and over-driving: they contain a serous fluid. The animal should have rest: astringent lotions may be used, and a bandage applied very tight. If they do not disappear, a little blistering ointment may be applied near them.

WINDLASS. A simple mechanical contrivance, of the wheel and axle kind, the winch, D C B, being the representative of the wheel (*Fig.*).



In heavy windlasses, as those employed on shipboard, the axis is large, and moved by levers inserted into mortices cut into it at convenient distances. A strong windlass, made by taking the trunk of a tree for the axis, and adjusting it lengthwise against the stems of two trees, might be used in tearing up stumps. This axis should be pierced with mortices and turned with handspikes; it should also be furnished with ratchets (pauls) or wedges, to hinder it from turning backward when the handspikes are out. A strong chain made fast in the stump, and to the windlass, will afford a means of acting upon the former, and, by cutting the longest roots at a little distance, it may be drawn out sufficiently to permit the use of the plough.

WINDMILL. "In mechanics, a mill which receives its motion from the wind. The building containing the machinery is usually circular. To the extremity of the principal axis, or wind shaft, are attached rectangular frames (generally five), on which canvass is usually stretched to form the sails. The surfaces of the sails are not perpendicular to the axis, but inclined to it at a certain angle, about 72° at the extremities nearest to the axle, and 83° at the farther extremities; so that their form is in some degree twisted, and different from a plane surface. The wind-shaft is inclined to the horizon in an angle of from 8° to 15°, principally with a view to allow room for the action of the wind at the lower part, where it would be weakened if the sails came too nearly in contact with the building.

"As the direction of the wind is constantly changing, some apparatus is required for bringing the axle and sails into their proper position. This is sometimes effected by supporting the machinery on a strong vertical axis, the pivot of which moves in a socket firmly fixed in the ground, so that the whole structure may be turned round by a lever. But it is now usual to construct the building with a moveable roof, which revolves upon friction rollers; and the shaft, being fixed in the roof, is brought round along with it. The roof is brought into the required position by means of a small vane wheel, furnished with wind sails, which turns round when the wind strikes on either side of it, and drives a pinion which works into the teeth of a large crown wheel connected with and surrounding the moveable roof."

This is the vertical windmill, but sometimes the sails are fixed on a horizontal axis. Windmills are seldom made because of their inferiority to water and horse, or steam power mills. The internal machinery is the same as that of the water-mill.

WINDROW. A line or row of grass, peat, or produce exposed to dry. The untilled borders of a field.

WINE. See *Vine.*

WINE STONE. Crude tartar, argal.

WINGS. *Alæ.* In botany, the side petals of pea-like flowers, the membranous expansions of the seeds of the ash, alanthus, parsnip, and other seeds.

WINLESTRAWS. Bents, the

withered flower-stalks of grasses standing in meadows.

WINNOWING. The separation of wheat or grain from chaff, anciently performed by throwing up shovelfuls into the air on a windy day, but now accomplished by the fan.

WINNOWING MACHINE. The wheat or grain fan. A machine for separating grain from chaff, and cleaning wheat from cockle, cheat, and other small seeds. It consists of a frame-work enclosing a fan, which is moved by a crank and wheel-work on the outside. The grain falls from a hopper at the top of the machine upon a sieve, to which a jogging motion is given by the crank; in this way it is sifted from stones or bodies larger than the grain. The current of wind produced by the fan blowing over the sieve drives out all light particles of chaff. The seeds which pass down from the sieve fall on the upper parts of an inclined shaking screen of wire, set too close for the transmission of plump grains, but allowing shrivelled seed, cockle, &c., to pass through. A machine is provided with three screens and sieves to enable the farmer to use it for different grain. Forty to fifty bushels can be cleaned in an hour with the common fans.

The English winnowing machines are combined with smut machines, and are therefore much more expensive and complicated. The following description is of Mr. Salter's patent:

"The undressed grain from the hopper passes through a cylindrical sieve, having within it a rotary spindle, upon which short, blunt arms are arranged in a spiral direction; these agitate the grain as it passes along, and thus separate the small dirt and dust as well as the awns of barley, which fall through in a closed box or cupboard. The cylinder is placed in a slanting direction, and is provided at each end with slides, which regulate the quantity and speed with which the grain shall pass. Through the slide aperture at the lower end, the grain is introduced upon other sieves, which, having a backward and forward motion, distribute it equally over their surface, when it is subjected to the blast of the fan, driving obliquely through the sieves; this carries the chaff out of the machine; the grain falls on a screen, which, having a similar motion to the sieves, separates from it all small seeds, and the dross corn is carried away in a division formed for the purpose. The grain, dross corn, and chaff are thus all thorougly separated from each other, and the dust, dirt, and small seeds, having fallen in an enclosed box from the cylinder, may be entirely removed."

WINTER BERRY. *Prinos verticillatis.* False alder, a shrub of four to eight feet, with permanent red berries, adapted to shrubberies.

WINTER CRESS. *Barbarea præcox.* An indigenous, perennial, cruciferous plant, growing in the Northern and Eastern States, near spring branches. It is very similar to water-cress, but more pungent in flavour. *B. vulgaris*, also indigenous, is the water-radish, or rocket.

WINTER GREEN. The genus *Chimaphila*; pretty Alpine plants. They are perennial, with long roots, and grow in the shade of woods. The *C. umbellata*, pipsissiwa, is used in domestic medicine as a tonic and astringent.

WINTER PROUD. A term applied to wheat or barley which appears too forward in winter, and hence frequently gets injured, and yields a poor harvest.

WIPERS. "In some kinds of machinery, as oil mills, powder mills, fulling mills, pieces projecting generally from horizontal axles, for the purpose of raising stampers, pounders, or heavy pistons, in vertical directions, and then leaving them to fall by their own weight. The principal object to be attended to in the construction of wipers is to give them such a form that the weight shall be raised with a uniform force and velocity."

WIRE GRASS. Several grasses are so called, but the true wire grass is the *Eleusine Indica*, an annual, flowering in spikes.

WIRE WORM. *Elater segetis.* See *Insects*. The following plan for the destruction of wire-worms is by a practical farmer, Mr. Tarrant: He cleans the infested field of all weeds and roots, and drills white mustard seed, keeping the land hoed, and by the end of the season finds the worms entirely gone.—(*British Farm. Mag.*, 1831.)

WISP. A small bundle of hay or straw.

WITHE. A flexible twig or bough.

WITHERITE. Mineral carbonate of baryta.

WITHERS. The high portion of an animal's back over the shoulders. Horses with high withers are said to have the fore hand well up; they go high above the ground, and are quick and safe. In draught horses the breadth or weight of the fore hand is desirable.

The word is sometimes applied to the womb of the cow. *Casting the withers* is inversion and protrusion of the womb. It should be returned by the hand and arm, and maintained in its place by a roll of linen introduced into the vagina in a wet state. The animal must be kept quiet and free from fever.

WOAD. *Isatis tinctoria.* See *Fig.* "It has been greatly superseded

by indigo, which gives a stronger and finer blue; but on some soils it might be still cultivated to great advantage, especially as it is said to improve the quality and colour of indigo when mixed with it in a certain proportion.

"The woad is a plant of the natural order of the *Cruciferæ*. It has a strong tap-root, which lasts two years. The height of the plant, when in perfection, is from three to four feet. It throws out many branches from the upper part of the stem. The leaves are alternate and smooth. The flowers are yellow, in panicles at the extremity of the branches. The fruit is a heart-shaped pod, with two valves, containing one seed only. It grows well on the borders of the Baltic, and is very hardy.

"It is still cultivated to a considerable extent in the south of France and Flanders. It requires a good substantial soil of considerable depth and fertility; for the larger and more numerous the leaves are, the more profit is derived from the plant. A wet clay soil is not at all suited to its growth, nor a loose sandy one.

"When it was largely cultivated in England, old pastures ploughed up afforded the best soil for the woad to grow in. To have good woad, the land should be naturally very rich, or much manure should be intimately mixed with it some time before. Nothing but completely decomposed dung should be used, or compost made on purpose a long time before.

"The land, having been prepared by repeated ploughings, and perfectly clean, is laid into narrow beds with deep intervals. On these beds the seed is sown as early in spring as possible. It is sometimes sown broadcast, and the plants thinned out; but sowing it in drills, two rows on a four-feet bed, is much the best practice. The drills are one foot from the edge, with two feet clear between them; some make five-feet beds, and there is an interval of thirty inches between the rows, which allows of better cleaning, and gives the plants more room to spread. When the plants are come up in the rows, they must be thinned out by hand, leaving the strongest about two feet apart: the leaves will soon fill up the intervals. They begin to ripen in June. They are fit to gather when they begin to droop and become yellowish: This should be done in very dry weather, and after the dew is off. The leaves of the woad are either twisted off close to the stems, or cut down with a sickle. Great care must be taken that no dirt or earth adheres to them. Some recommend taking off the lower leaves first, when they appear ripe by drooping and turning yellow, and letting the upper leaves remain till they show the same appearance; then nothing but ripe leaves will be gathered. This stripping may be repeated two or three times, as the leaves grow again. The plants destined for seed are only stripped once or twice, for fear of weakening them. It might probably be advantageous not to strip them at all, but to leave the whole strength for the formation of the seed, which will be larger and produce finer plants the next year.

"The first gathering of the leaves is the best; they should therefore be kept separate, to obtain the best dye. As soon as the leaves are gathered the beds should be well and deeply hoed or dug, to give a fresh impulse to the roots.

"The leaves are naturally full of sap, and soon begin to decompose if laid in a heap. They should therefore be partially dried, and immediately carried to the mill to be manufactured.

"There is a variety of this plant cultivated in Flanders and about Valenciennes, which has seeds of a violet colour, and the leaves very smooth; it is larger than the other, and gives a better dye. It is that which is cultivated near Avignon, whence the best woad dye is procured. The leaves are ground in a mill, like an oil mill, into a paste, which, when quite uniform and smooth, is laid in heaps under a shed, and pressed with the hands or feet into a mass: each addition is carefully joined to the preceding, so that the whole crop forms a long heap. A fermentation is soon established, by which the blue dye is separated. A black crust is formed all over the heap, which keeps in the gases produced. If any part of this crust is cracked, it must be immediately stopped up with some of the paste. It takes a fortnight to complete the operation. When the disengagement of gas ceases, which is soon perceived by the smell, the heap is broken up, the crust is mixed with the inside, and small portions, like bricks of about one pound weight, are made up with the hands by pressure in a mould, which, when dry, are fit for sale. As great attention is required both in the growing and preparing of the woad, it is best done by those who make a trade of it, and have the necessary experience. When the crop succeeds, the profit is very considerable; but, like all other crops, it is liable to many accidents.

"Woad is often shamefully adulterated with earth and other impurities. In Germany the process of preparing the woad is somewhat different. The leaves are first washed, and then put into a tub three quarters full of water, and kept under water by blocks of wood laid on them. The fermentation soon begins, and is shown by a blue scum on the water. When it has gone on to a certain point, the water is drawn off below, and it comes away of a deep green. It is strained through a cloth, the remaining leaves are washed with fresh water, and this is added to the first. Lime-water is now added, in the proportion of two or three pounds for every ten pounds of leaves used, and the mixture is well shaken for some time; the dye is deposited in the form of a powder, as starch is; the water is decanted off, and the thick part at the bottom is filtered through very fine cloths; the powder which remains is washed repeatedly, till the water comes off without being discoloured. The residue is cut into squares and set to dry. If there is too much water added, the dye is inferior; and if not enough, there is less of it. The exact quantity can only be decided by practice and experience.

"The seed will vegetate when two years old, but cannot be depended on after that.

"Woad is also occasionally sown as food for cattle; and as everything, old and new, has been brought forward by the late renewed zeal for agriculture, it has been recommended for this purpose under its French name of '*Pastel.*' Its vigorous growth and hardy nature have recommended it; but it will only grow in very rich soils. There are many other plants as vigorous and hardy, which will thrive well in inferior soils, and therefore are to be preferred. But for its dye, this plant is well worthy of the attention of those who have good rich and deep soils."

WOLF. On the prairies much loss is sustained by shepherds from the attacks of wolves; these may be destroyed in the same way as the fox, or poisoned by sprinkling twenty grains of arsenic on some offal placed in their way. Some use a quarter of a grain of *strychnine*, inserted in a piece of meat.

WOLF'S BANE. Monk's hood.

WOLLASTONITE. A species of prismatic augite.

WOOD. The substance of the trunk of exogenous trees; it consists of an internal hard and coloured portion, the heart-wood (*duramen*), and an external, softer, and more perishable part, the new wood, sap wood, or alburnum. It consists of woody fibre and ducts. (See *Timber*, and the different trees.) The composition of oak wood, according to Gay Lussac, is, carbon, 52·5; oxygen, 41·8; hydrogen, 5·7 per cent. Wood decays slowly, and yields water and carbonic acid when in contact with air.

WOOD ASHES. The saline bodies of trees: they are obtained for their potash. Oak and hickory ashes contain from twenty to twenty-five per cent. of real potash, and yield the best ashes. As a manure, ten bushels of fresh ashes to the acre in compost are enough, but if unleached, twenty or more may be employed. See *Ashes* and *Potash*.

WOODBINE. The honeysuckle.

WOOD SORREL. The genus *Oxalis*, the leaves of which are sour, and contain oxalate of potash: they grow in rich, shady places. Many species bear beautiful flowers.

WOOD WASPS. The saw flies.

WOOD WAXEN. *Genista tinctoria.* Dyer's broom, a perennial leguminous plant, with yellow flowers, growing one foot high, leaves lanceolate, smooth, stem round, upright, without spines. It is exotic, but grows readily in the Northern and Eastern States. The plant in flower yields a yellow dye, which is fixed by solution of tin or acetate of alumina. It may be readily raised from seed, in drills a foot apart, and the plants kept clean by the cultivator.

WOODY FIBRE. Very slender, tapering cellular tissue, containing lignin, and forming, when compacted together, the tough fibre of hemp, flax, and vegetables, as well as the bulk of wood.

WOOL. Hair which is somewhat curled and possesses the quality of felting; this results from numerous serratures on the staple. For the qualities of wool, see *Sheep*. The value of wool depends upon the fineness, felting quality, and trueness of the staple, which are explained in the article on *Sheep*; but the quality of a fleece is not the same throughout: it is, indeed, divisible into four parcels. In some parts of Europe it is the custom for the farmer to make the separation, but in the United States this is left to the manufacturers. The only preparation necessary is to remove burs, tags, and the coarse hairs of the legs, which is done before shearing. The sheep is washed a week or ten days before shearing, in a cistern or trough, or, what is preferable, a running stream; the tags are first removed, and the washing made perfect by squeezing the wool. In the case of Merino bucks a little soft soap may be used, for the cleaner the wool the higher the price obtained. In Spain, it is the custom to sweat the sheep the night before shearing, by keeping as large a number as can be crowded together in a hut: the wool is removed the next day without being washed, that operation being conducted afterward. The wool is first sorted into three parcels; in some places these parcels contain the different qualities: 1st, superfine picklock (*refina*), taken from the back, flanks, and sides of the neck; 2d, fine (*fina*), from the breast, belly, sides of the haunches, and upper part of the neck; 3d, third kind (*tercera*), from the cheeks, upper part of the throat, the fore legs above the knee, the hams, and back of the haunches; the fourth quality, or *cayda*, is refuse, and is from the tail, rump, lower parts of the legs, and between the legs. The assorted parcels are hence treated separately: first they are beaten on hurdles; then placed in vats containing water heated to 120° Fahrenheit, where they are stirred with sticks; then removed to drain and transferred to a running stream; here the wool is pressed by the feet of the workmen, and finally thrown out to dry on the grass: in a few days of hot, dry weather it becomes sufficiently dry to be packed. When sheep are washed, as with us, the wool is by no means so clean; indeed, Spanish Merino wool by scouring only loses ten per cent., whereas American Merino loses forty per cent. The washed sheep are transferred to clean meadows, and if fed in sheds, they should be laid with clean straw. If the weather be fine, in a week the fleece will be dry, and a new secretion of yolk will have increased its weight.

The shearing must be postponed to fine, warm, settled weather, and may take place in a well-lighted barn, the floor of which is spread with straw and then covered with a canvass; but a clean sward is well enough. (See *Shearing.*) The fleece is to be removed carefully, the wool cut truly, and not clipped irregularly, but severed with each stroke of the shears. A good workman can manage 25 to 30 sheep a day of the Merino breed. All tags, burs, and hair about the legs should be removed before bringing the sheep on the canvass, which is to be done with management, and not violently. The removal of hair is important, as it affords shelter to ticks, and may hide diseases of the skin. After shearing, the sheep should be classified, according to the wool they produce, their healthiness and form, and marked so as to carry out the views of their owner. They may be marked with a hot iron on the forehead, or with an ointment of lampblack and lard: tar is objectionable on the wool-bearing parts.

The fleeces are piled one on the other until the shearing is done; or they may be removed by a new hand, and carried to a table, one by one, to be rolled. With each fleece the loose locks are taken, but the hair of the legs separated and placed in a bag or elsewhere. The fleece is carefully spread out on the table, the ragged portions on the edges are separated, and, with all the loose wool, thrown into the middle. The workman next presses the sides inward, so as to condense the wool; the sides and ends are then turned over, so that the folded fleece forms an oblong two or three feet long and one and a half feet wide; this is drawn to the front edge of the table and rolled, during which the assistance of a boy is necessary to press the wool together and condense it; the roll is finally tied with a stout twine. The fleeces are preserved in a well-ventilated loft. When sold, they are put up in bales: these are made of burlaps; a piece of a yard wide and three yards long is used for a sack. The sack is kept open by a hoop, and the fleeces pressed down by a man until the bag is nearly full; it is then made up and sewed along the top.

The weight of a fleece, and the price it fetches in the market per pound, are subject to considerable difference. The following represents the average fleece: Saxons, 2 to 3 lbs.; Merinos, 2¼ to 3 lbs.; South Downs, 3 to 4 lbs.;

new Leicesters, 6 to 7 lbs.; Cotswolds, 7 to 8 lbs.; Lincolns, 8 to 10 lbs. The price of wool per pound, as reported in 1845, was, Saxony, 35 to 50 cents; pure Merino, 30 to 35 cents; half-blood Merino, 25 to 30 cents; common country sheep, 20 to 25 cents. The wool of the English kinds are not separated, but are worth about the same as the half-breed Merinos.

WOOL-GROWING. In the article *Food*, we remarked that provender differed in its effects, some kinds, as the oily seeds, producing rapid fattening; others, as the dry grains, serving to sustain strength. The fodders best calculated to increase the weight of wool may be ascertained theoretically by considering the composition of that staple (see *Woollen Rags*); it is there seen that 100 lbs., in the ordinary state, contain 17·7 nitrogen, a quantity unusually large. The inference is, therefore, that azotized or nitrogen food is best calculated for the increase of wool, and that pease, beans, rye, barley, may be judiciously given. On this point theory is also abundantly confirmed by the experiments of M. de Raumer, of Silesia. The following table exhibits the value of 1000 lbs. of various fodders in increasing the live weight, producing wool and tallow: the sheep were Saxons:

Kinds of food.	Increase of weight in live animal.	Produced wool.		Produced tallow.		Nitrogen per cent. in food.
		lbs.	oz.	lbs.	oz.	
1000 pounds of raw potatoes, with salt . . .	46½	6	8¾	12	5½	0·36
1000 " " " without salt .	44	6	8	10	14½	0·36
1000 " raw mangold wurzel . . .	38	5	3½	6	5½	0.21
1000 " pease	134	14	11	41	6	3·83
1000 " wheat	155	13	13½	59	9	2·09
1000 " rye, with salt	90	13	14½	35	11½	2·00
1000 " rye, without salt	83	12	10½	33	8½	2·06
1000 " oats	146	9	12	40	8	1·70
1000 " barley	136	11	6½	60	1	1·90
1000 " buckwheat	120	10	4½	33	8	2·10
1000 " good hay	58	7	10½	12	14	1·15
1000 " hay, with straw, without other fodder	31	15	8	6	11	——
1000 " whiskey still-grains or wash .	35	6	1	4	0	——

The daily ration of the sheep is regulated in the same way as for cattle; two per cent. of the weight being allowed for those in an ordinary state, and more for such as are put up to fatten; 2 to 2½ lbs. of hay, or its equivalent in other fodders, are about the average. In M. de Raumer's experiments the animals were permitted to eat all they would, and the result shows that they took each daily of potatoes, sliced, 7 lbs., with straw; mangold, 8 lbs., with straw; pease and beans, 2 lbs.: these should be soaked in water or steamed, to enable the sheep to chew them; wheat, rye, barley, oats, from 2 to 2¼ lbs.; buckwheat, 3 lbs.: in every instance where dry fodders were given, the animals required two or three quarts of water.

WOOLLEN RAGS. They are used as manure, at the rate of half a ton to the acre, either alone, chopped into pieces not exceeding half an inch square, or in compost. The hop, tobacco, turnips, and plants requiring much putrescent manure, are most benefited. Wool is almost identical in composition with hair, horns, and feathers: it consists of 50·6 carbon; 7·0 hydrogen; 17·7 nitrogen, and 24·7 oxygen, with a very small amount of ash. The rags alone will show good effects for four or five years. In their decay, 100 pounds produce 20 pounds of ammoia, which is liberated in the form of carbonate. When rotted in compost, 200 pounds will be enough to the acre, spread as a top-dressing on growing plants.

WOOL SHEARS. Sheep shears.

WORM. A common name for caterpillars and the tribe *Vermes*. See *Cut Worm*, *Wire Worm*.

WORMING. An operation performed on puppies, consisting in the removal of a vermiform ligament from under the tongue: it is sometimes supposed to prevent madness, but, in fact, merely breaks them of their habit of gnawing.

WORM SEED. Goosefoot, Jerusalem oak. An oil is distilled from the seeds, and called worm-seed oil: it is exceedingly nauseous, and is given to children in the dose of five to ten drops, and followed by cathartics. See *Goosefoot*.

WORMS, INTESTINAL. There are many species infesting animals, especially horses. The principal are *bots; lumbrici*, or round, long worms, resembling the earth worm; *ascarides*, which are slender and with flattened heads, and *tæniæ*, or tape worms.

The effects of worms are soon seen in the health of animals; they get poor, low-spirited, and weak, notwithstanding their appetite is often voracious. As soon as these symptoms are discovered, measures must be taken for the expulsion of the worms: this is not easily accomplished, but purgatives containing calomel, jalap, and aloes are most effective. The tape worm must be previously killed by doses of turpentine; for this purpose, a wine-glassful should be given at intervals of six hours, three or four times, until portions of the worm arê evacuated by the purge. See *Bots, Horse*.

WORMWOOD. The genus *Artemisia*, including southernwood, mugwort, &c. They are composite, bitter perennials, with a strong, rank odour, and have been much used as tonic bitters, and some species are vermifuges. Common wormwood is *A. absinthium:* the French flavour a cordial with it. The seeds of any of the species grow readily in the United States: they are also propagated by root slips.

WORT. A decoction of malt; an old name for an herb.

WOULFE'S APPARATUS. A series of two or three necked bottles, connected by intermediate tubes, used in the chemical laboratory for impregnating water and other liquids with various gases or vapours.

WOUND. A division of the soft parts. If it be a clean cut or incised wound, all that is necessary is to wash the parts with tepid water to remove all dirt, and bring the sides of the wound together with sticking plaster. Torn and contused wounds do not heal so kindly, but often run into suppuration. If an artery be divided, it is first to be tied with a silk thread before the wound is closed.

WOUNDWORT. The genus *Stachys*, weeds of little account.

WROUGHT. Materials which have been brought to a surface by hammering or other labour.

X.

XANTHINE (from ξανθος, *yellow*). A yellow colouring principle in madder.

XANTHOPHYL (from ξανθος, and φυλλον, *a leaf*). The yellow colouring matter of autumnal foliage.

XYLITE (from ξυλον, *wood*). *Lignone*, an empyreumatic spirit existing in the products of vinegar distilled from wood.

XYLOPHAGANS, XYLOPHAGA (from ξυλον, and φαγω, *I eat*). A tribe of coleopterous insects, comprehending those of which the larvæ devour the wood of trees in which they are developed; also applied to a family of dipterous insects, the larvæ of which have similarly destructive habits.

XYLOPHILANS, XILOPHILI (from ξυλον, and φιλεω, *I love*). A tribe of beetles, consisting of those which live on decayed wood.

XYLOTROGES, XYLOTROGI (from ξυλον, and τρωγο, *I gnaw*). A tribe of serricorn beetles, comprehending those which perforate timber.

Y.

YAK. The Himalayan bison, resembling the buffalo, three and a half feet high, and with fine, long hair.

YAM. The tuber of the *Dioscorea sativa, alata*, and other species. It is similar to the sweet potato, but much larger. The cultivation is the same, only that a stake is driven near each plant, to allow the stem to climb.

YAM ROOT. *Dioscorea villosa.*

An indigenous perennial climbing plant, of the same genus as the yam.

YARD DUNG. Farm-yard manure.

YARD OF LAND. A measure varying from 15 to 34 acres.

YARROW. The genus *Achillea*. Bitter, aromatic weeds, of the composite family. They are wholesome, and are found in good pastures, especially *A. millefolium*, common yarrow. They have been recommended for cultivation.

YEARLINGS. Calves and other stock one year old.

YEAST, BARM. The substance produced during the vinous fermentation of vegetable juices and decoctions, rising partly to the surface, in the form of a frothy, flocculent, and somewhat viscid matter, insoluble in water and alcohol, and gradually putrefying in a warm atmosphere. It excites fermentation, and accelerates the process when added to saccharine liquors. It is changed gluten and other protein compounds in incipient decomposition.

Artificial yeast, or that made without recourse to the introduction of a portion of yeast, is very important in families. The following recipe gives a good yeast: Boil a handful of hops in three pints of water; add three mashed boiled potatoes, strain, and mix with a cupful of flour; set aside to cool, and then add a tea-spoonful of sugar, and bottle up for use. A more permanent ferment is made by boiling a quantity of wheat bran and hops in water; the decoction is not long in fermenting, and when this has taken place, throw in a sufficient portion of bran to form the whole into a thick paste, which work into balls, and afterward dry by a slow heat. When wanted for use, they are broken, and boiling water is poured upon them; having stood a proper time, the fluid is decanted, and in a fit state for leavening bread. In the place of bran, Indian corn meal may be used, if a little of a previous ferment be broken up in the mass.

YELLOW DYES. Persian berries, weld, quercitron bark, fustic, turmeric, dyer's broom, annotta, willow leaves, berberry roots, are the principal vegetable dyes. Chrome yellow, oxide of iron, sulphurets of antimony and arsenic, and nitric acid are obtained from the mineral kingdom. Solutions of alum and tin are used as mordants.

YELLOW FEVER. A bilious remittent fever of a malignant kind. It attacks animals as well as men, but does not so readily destroy them. Large doses of calomel, with bleeding, in the earliest stages, form the best treatment; but in the later stages the system is often so prostrated that it requires sustenance from spirituous liquors and carbonate of ammonia.

YELLOW RATTLE. The weed *Rhinanthus cristagalli*.

YELLOWS. Jaundice, irritation of the liver, attended with a yellowness of the eyeballs. A calomel purge is necessary, and bleeding, if there be fever.

YELLOWS IN TREES. This, which is called a disease of trees, is only an effect produced by different causes, such as plant lice, worms at the root or in the bark, and improper soils. The leaves turn yellow, and nutrition being cut off, they usually die. Whenever this symptom is seen during early summer, the tree should be thoroughly examined, to ascertain the cause, and treated accordingly. Scraping the bark, making an incision from the branches to the root, and washing the stem, root, and large branches with solution of whale-oil soap may be found serviceable. Plant lice are to be smoked with tabacco. See *Plant Lice*, *Borers*, and *Scale Insects*. Peach trees are very liable to this ailment in the Northern States.

YELLOW SEED. The weed *Thlaspi campestre*, false flax, mithridate mustard, a cruciferous annual with mustard-flavoured pods, which abounds in flax fields, and is very troublesome. It can only be avoided by screening the flax seed carefully, and omitting the cultivation of flax for a season, introducing cleaning or hoed crops instead.

YELLOW TOP. White top. *Agrostis alba.*

YELLOW WASH. An application to ulcers. It is made by adding a drachm of lime-water to two grains of corrosive sublimate dissolved in one ounce of water.

YELLOW WEED. The buttercups, or *Ranunculus*, are so called.

YELLOW WOOD. *Virgilia lutea.* A medium-sized leguminous tree of West Tennessee, seldom attaining forty feet, and growing in rich, deep soils. The leaves are large, smooth, pinnate; the flowers in pendulous clusters, like the locust, and white. It is a highly ornamental tree, and an infusion of the bark affords a yellow dye.

YEW. The genus *Taxus*, coniferous trees and shrubs, with evergreen, small leaves, of slow growth, but producing very hard, strong wood, formerly reputed for bows, and now used in cabinet-work. The *T. baccata* is the yew-tree; the *T. Canadensis* is a shrub of five feet. They make good hedges, but the leaves are poisonous.

YOKE. A frame of wood fixed with bows over the necks of oxen, whereby they are coupled together, or yoked. It is sometimes written "yoak," and is composed, 1. Of a thick piece of wood that passes over the neck, and is properly called the "yoke;" 2. Of a bow, which encompasses the neck; and, 3. Of the "wreathings," or "stitchings," that serve to connect the whole. Besides these parts, there are employed a ring, denominated the "yoke-ring," and a chain for securing the traces. For a new method of yoking, see *Ox Yoke.*

Yoke is also an old measure of land, the quantity ploughed in a day by a couple of oxen.

YOLK. The yellow of the egg. An animal soap, also called gum, secreted by the skin of sheep, and pervading the wool. The finest fleeces contain most yolk, especially that of the Merinos. It is readily softened by warm water, and may be washed out without trouble; but there remains an oil among the wool, which is only separated with trouble. The amount varies from twenty to fifty per cent. of the fleece, and is most in warm climates and fine fleeces.

YTTRIUM. The metallic base of yttria, a rare earth resembling alumina.

YUCCA. Adam's needle, bear's grass. A genus of shrubby, liliaceous plants, with large, rigid leaves, inhabiting the sandy sea-coasts of Georgia and the South. The Sisal hemp is of this genus, and the leaves of all the species may be wrought into a long staple. The *Y. gloriosa*, petre, is celebrated for its magnificent inflorescence, and yields strong hemp. The roots of some species abound in farina, and were used by the Indians for food.

YULE. Christmas.

Z.

ZAMIA. A genus of cycadeous trees, the stems of which yield a kind of sago. The *Z. integrifolia* and *Z. pumila* grow in Florida, and furnish sago, or what is improperly called arrow-root.

ZAPZIEGER CHEESE. Sap sago. See *Cheese.*

ZEA. The generic name of the Indian corn (*Z. mays*).

ZEBRA. The zebra is of the size and general appearance of the mule, but with a skin striped with brown, or black and white: it has not been domesticated.

ZEDOARY. *Curcuma Zedoaria.* An East Indian plant, of the same family as the ginger, but producing rhizomes not quite as pungent.

ZECKSTEIN. A magnesian limestone, lying below the red sandstone.

ZEIN. The azotized product of Indian corn, similar to albumen.

ZENITH. The vertical point in the sky of any place; the point immediately overhead.

ZEOLITE. A family of minerals which fuse and boil before the blowpipe; they are silicates of alumina and lime, or soda with water. The soda zeolite is called *Natrolite.*

ZERO. Nothing; it is used to designate the 0° point of graduated scales, as the thermometer, areometer, and usually means a degree equal to a given test; thus, the zero of the areometer is the specific gravity of pure water at 59° Fahr.; the zero of Fahrenheit's thermometer is the temperature of snow mixed with salt. The zero of the Centigrade and Reaumer scales is the freezing point. Degrees above zero are plus (+), below it minus (—).

ZERUMBET. An East Indian rhizome, similar to ginger.

ZIMOME. That part of the gluten of wheat which is insoluble in alcohol.

ZINC. Spelter. A valuable metal for roofing and the construction of vessels, such as are made of tin plate, than which it is more durable and stronger. In chemistry, it is of great use for the construction of galvanic circles and batteries, forming the positive surface or pole of single circles. It is rapidly acted on by the strong acids, and forms an oxide which combines with most acids. Of its salts, the *sulphate*, or white vitriol, is most employed; it is emetic and irritant, and used chiefly in lotions. See *Pharmacopœia*. Calamine is an impure native carbonate of zinc. Tutty is an impure artificial oxide.

ZINCOUS, ZINCOID, ZINCODE. Resembling zinc. This term is used to designate any metal or other body which, in a galvanic circle, occupies the place of the zinc. It is the same as positive metal or pole, positive electrode, anode, and the derivatives. *Zincolysis* means the same as electrolysis; *zincolyte*, as electrolyte. These terms are indeed to be preferred over those previously in existence, because they refer to the zinc element, or its substitute, as the origin of the galvanic action.

ZINGIBER. The generic name of the ginger plant (*Z. officinalis*).

ZIRCONIUM. A rare metal, the base of zirconium.

ZIZANIA. Wild rice. See *Rice, Wild*.

ZIZIPHUS. The generic name of the shrubs yielding the jujube (*Z. jujuba*).

ZONE (from *ζωνη, a belt*). A word much used by naturalists to denote a band or stripe running around any object. In geography, a division of the earth's surface. There are five great zones. The *tropic* or *torrid zone*, occupying the central or equatorial regions of the earth to a distance of 23½ degrees north and south, and therefore having a width of 47 degrees. The *north temperate zone* lies between 23½ N. lat. and 66½ N. lat., and occupies 43° of latitude. The *south temperate zone* lies in the same space on the south side of the globe. The *north* and *south frigid zones* occupy the space beyond 66½ degrees to the poles: they are also called the arctic and antarctic regions.

ZOOLOGY (from *ζωον, an animal*, and *λογος, a discourse*). The history and classification of animals. The objects of the animal kingdom are so extremely various that a classification of them is one of the severest labours. Numerous suggestions have been made as a basis for classification, but the advance of knowledge has shown them all to be wanting in comprehensiveness. When it is remembered that under the term animal is grouped thousands of species differing from the scarcely organized and imperceptible dots of jelly called *monads*, to the most complicated quadrupeds, the difficulties of classification will be apparent. The following view by Professor Owen is the most complete we have seen.

In this there are four primary divisions, or sub-kingdoms: 1. *Vertebrata*, or animals furnished with a regular back bone: 2d. *Articulata*, animals which contain no internal skeleton, but are covered with a crust or shell made of distinct parts or articulations, as the lobster; 3d. *Mollusca*, animals destitute of skeleton or articulations, but usually inhabiting shells; and, 4th. *Radiata*, animals of the lowest organization, destitute of an internal respiratory organ, and having a nervous system composed of mere lines, which are often radiated from a centre. These sub-kingdoms contain each several classes, as may be seen in the table.

Kingdom Animalia.

Sub-kingdom *Vertebrata.*

Class Mammalia, *mammals.*
Aves, *birds.*
Reptilia, *reptiles.*
Pisces, *fishes.*

Sub-kingdom *Articulata.*

Class Crustacea, such as *lobsters.*
Arachnida, *spiders.*
Insecta, *insects.*
Anellata, *worms.*
Cirripedia, *barnacles.*

Sub-kingdom *Mollusca.*

Class Cephalopoda, with a cartilaginous head.
Gasteropoda, with an organ for locomotion situated under the stomach, as the snail.
Pteropoda, organs of locomotion two membranous fins, situated at the sides of the neck.
Lamellibranchiata, without head, the gills disposed in bands, as oysters.
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Tunicata, without head, without shell, covered with a membrane.

Sub-kingdom *Radiata.*

Nematoneura, nerves apparent.

Acrita, nerves rudimentary.

Class Echinoderma (Cuvier), those furnished with a crust.
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Cœlelmintha (Owen), Entozoa, with a distinct alimentary canal.
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