teeth set in echelon, the teeth of each row being in end contact or union with each other, and set so that the first tooth in any one row enters in gear with the opposite wheel while one or more teeth of the preceding row are yet in gear, whereby a majority of the sectional rows of teeth will always be engaged in the opposite wheel at one time, the precise number thus engaged depending on the number of sectional rows of teeth in the wheel, whether two, three, four, or more, also upon the height of the teeth and coarseness of the pitch.

Mr. John H. Holmes, of Charleston, Kan., has patented an improved rotary dasher or breaker for employment in vertical churns.

THE HUNTING FALCON.

Among falcons the hunting falcon is the most conspicuous on account of the great size and the striking power of its wing. This bird is a native of northern Europe, being mostly found in Iceland and Norway, and it also inhabits parts of both North and South America.

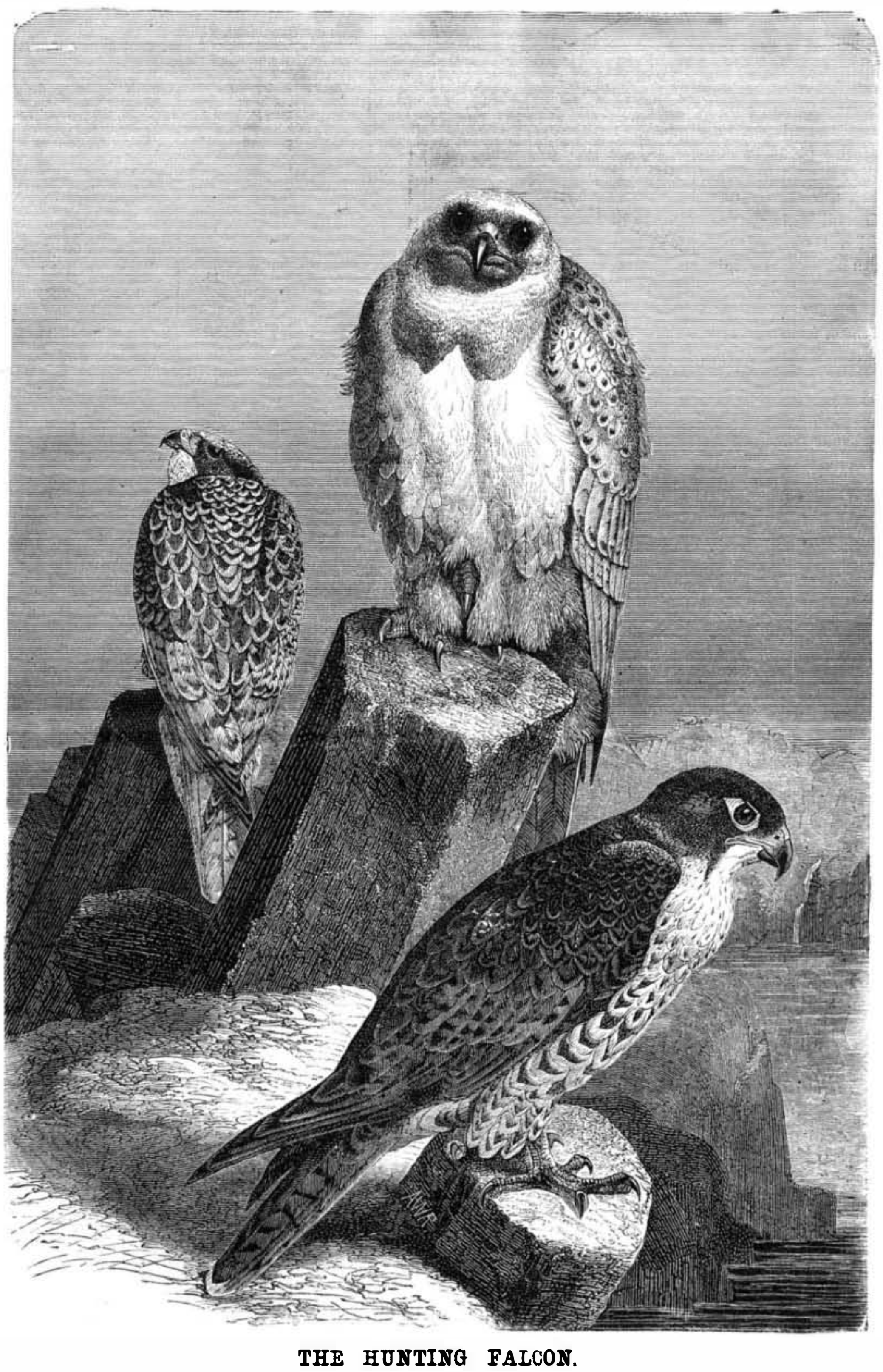
Some naturalists believe that the Norwegian and Icelandic birds ought to be reckoned as different species, but others think that any differences between them are occasioned by age and sex. The power of flight of these birds is marvelously great. When it comes within sight of its prey it bounds upward, every stroke of the wings producing a perpendicular leap, as if it were climbing a giant stairs. After having risen to the proper height it dashes itself upon its prey with a stroke that is as unerring as its motion is swift.

When at liberty it seems to prefer birds to any other kind of prey, and will resolutely attack birds of considerable size, such as herons or storks. It will also chase hares and rabbits, and in the pursuit of this swift game is so eager that after knocking over one hare it will leave the maimed animal struggling on the ground while it goes in chase of another.

Although its home is in the chilly wastes of the northern regions, the bird is in no want of food, finding ample supply in the sea birds which swarm around the tall cliffs that rise from the waves.

On account of the singular power, swiftness, and courage of this bird it was in former days held in the highest estimation, and could only be purchased at a most extravagant price. The training of this bird to fit it for the chase is a long and tedious process, requiring a longer time than the training any other bird.

The color of the adult bird is nearly white, being purely white on the under surface and flecked with grayish-brown spots on the upper side. The sharp claws are black, the beak of a bluish tint, increasing in darkness toward the point, and the cere, tarsus, and toes are yellow. When young the bird presents a different aspect, and would hardly be recognized as belonging to the same species. In its earlier life it is almost wholly of a grayish-brown tint, the feathers being slightly marked with a little white upon their edges. As the bird grows older the white edges become wider by degrees until the entire feather is of a snowy whiteness.



THE HUNTING FALCON.

Landscapes Changed by Animals.

All animals, says Professor Mivart in the *Contemporary Review*, are directly or indirectly supported by plants, and the range of plants and the very existence of species are often wonderfully affected by the appearance on the scene of even one new kind of animal. Thus a great grazing district at the Cape, called the "Midlands," was, in Burchell's time, covered with luxuriant greensward, with a few trees and bushes, with willows and acacias along the sides of its streams. The introduction of sheep first destroyed the grass and then most of the shrubs—a change which affected the rainfall, so that this region has been invaded by the hardy plants of the adjacent Karroo desert, and is fast becoming an extension of the desert itself. St. Helena, when discovered by the Portuguese, in the year 1502, was entirely covered with forests (the trees drooping over its high precipices overhanging the sea) and with a rich flora of absolutely peculiar plants. In 1513 some goats were introduced, and in fifty years had multiplied into thousands. Yet in 1709 trees still abounded, and the peculiar native ebony tree was still so abundant that it was used to burn lime with. In another hundred years (1810), the goats had entirely destroyed the great forests, yet so rich was the soil that it was hoped, with the destruction of the goats (and they were destroyed) the island would regain its wood by a quarter of a century. But this was not to be, for the government of that day most unhappily planted the island with trees and shrubs from other countries, which have so grown and spread that now the old indigenous flora is almost confined to a few patches on the central ridge of the island, at a height of 2,700 feet. What has been lost may be judged by the fact that of the forty-five kinds of flowering plants and twenty-three species of ferns which yet survive, no less than forty of the former and thirteen of the latter are absolutely peculiar to the island.

Preserving Timber in Ground.

In speaking of the well known methods of preserving posts and wood which are partly embedded in the earth, by charring and coating with tar, it is said these methods are only effective when both are applied. Should the poles only be charred without the subsequent treatment with tar, the charcoal formation on the surface would only act as an absorber of the moisture, and, if anything, only hasten the decay. By applying a coating of tar without previously charring, the tar would only form a casing about the wood, nor would it penetrate to the depths which the absorbing properties of the charcoal surface would insure. Wood that is exposed to the action of water or let into the ground should first be charred, and then, before it has entirely cooled, be treated with tar till the wood is thoroughly impregnated. The acetic acid and oils contained in the tar are evaporated by the heat, and only the resin left behind, which penetrates the pores of the wood and forms an air-tight and waterproof envelope. It is important to impregnate the poles a little above the line of exposure, for here it is that the action of decay affects the wood first, and where the break always occurs when removed from the earth or strained in testing.

Taking Care of Fresh Meat.

The time for slaughtering beef and pork for home consumption is close at hand, and it is a busy time for housekeepers; and if the truth is told, it is not a very pleasant task to contemplate; but as the comfort and happiness of a family depend very much on the manner in which meats are prepared, it is an essential item in every farmhouse that it should be done in a judicious and proper manner.

It is to be hoped that the good man of the family is both competent and willing to cut up the meat when cool without the assistance of his wife, and also to pack and salt the pork in the barrels in the cellar. If he does not know how, it would be highly advisable for him to take a few lessons of an experienced teacher, for it is a job that no woman ever ought to attempt. She of course would see that the pork barrel was perfectly sweet and clean before it was used. The brine, if kept nicely, will answer to use year after year by scalding and skimming and letting stand till cold before turning it over the pork. Pork must be cold before it is packed—all the animal heat entirely out of it—then, when packed down, an abundance of good coarse salt must be freely spread over every layer of the pork, then allow it to stand two or three days before turning on the brine. Place a heavy flat stone on the top of the barrel, so that the meat will be kept solid in its place. It is best to keep the stone on meat the year round, so that none of the pieces can float on the brine, as they are apt to do unless kept in place by a heavy weight. Have the brine cover the entire mass of pork, so as to exclude air. There is so much lean meat in the hams and shoulders of a hog, that they never ought to be salted with the solid pork. A pickle should be made expressly for their curing, as they can be made so much more palatable than when simply salted. The spare ribs of pork are better to be frozen and kept fresh until needed for cooking. The tenderloin can be frozen, too, and it is one of the most delicious parts of the whole, either broiled and buttered or fried. The head needs to be cleaned nicely, and soaked in a weak brine till the blood is all out. Some like it boiled, and others prefer it made into head-cheese and kept for cold meats. The feet and legs are to be scraped thoroughly, boiled till tender, and prepared as souse, or eaten hot, with turnip sauce for a relish. The trimmings of the pork—the neck pieces and the jowls—are nice made into sausages, and they keep all through the winter, to use at pleasure. The lard of course needs care immediately, but it is much better to let it soak in water over night before trying it out. Always keep the roundabout and leaf separate, and use the lard from the roundabout in cold weather, as it is liable to have a strong taste if kept till summer. The tongue and heart make good meat for mince pies, and the liver is palatable and wholesome, either boiled or fried. Beef that is kept fresh for winter use ought to be frozen as soon as possible, and then packed in tight barrels and set in a cool place, where the changes of atmosphere will not reach it. Some bury the barrel in an oat bin; others cover it with snow or put it in the hay mow—the main object being to keep it from thawing out. Beef hams must be cured in a nice pickle for some six or eight weeks, and then taken out and drained, put into either cloth or paper bags, and hung near the kitchen stove to dry for summer use; the tongue can be pickled with the hams, and kept for any length of time. The neck pieces and heart are used for mince pies, and need a thorough soaking in water to extract the blood. The beef to corn must be soaked two or three days in a weak brine, then packed in a tight cask or barrel, with salt sprinkled freely between the layers, and held down by a stone, in a pickle made and poured over it. It should be kept in a cool place in the cellar during the summer, and a sprinkling of black pepper over the top of the brine will keep the flies at a distance.

There is a great amount of work and care required to keep a year's stock of meat in good, wholesome condition, but if it is properly cured to commence with, two thirds of the labor is saved, and all the worry. No farmer can afford to patronize either the meat cart or the market for a supply of meat through the year. It is more convenient as well as more economical to lay in a store for family use that has been fattened at home, and then you are sure you have a good article, that is safe to use.—*Farmer's Wife in Country Gentleman.*

THE NUTRITION OF ROOTS.

The microscope does not show openings in the cellular tissues of a root through which even the most minute particle of solid matter could pass, and there is no mechanical power that could pulverize any solid so fine that it could pass through those extremely small canals which enable the root to absorb nourishment in a liquid or gaseous form.

For a long time the absorbing power was supposed to be localized in a special organ at the end of the root. But this has been disproved, as the vegetable cone situated there is covered with a skin that possesses little or no power of absorption.

The maximum of absorption takes place directly above this cone, in a part of the root covered with peculiar fibers. In ascending the root these fibers gradually diminish and disappear, and higher still the skin itself exfoliated, and is replaced by a new tegument that grows less and less permeable with age. Both the anatomy of the plant and experiment prove that the absorbing power diminishes from the point to the base of the root.

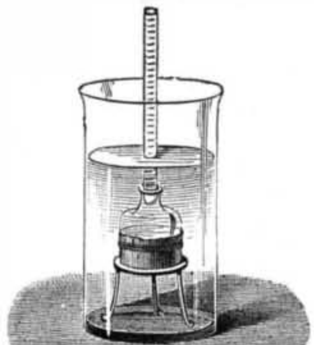
The subterraneous nutritive fluid of the soil is always very poor in plant building substances, of which it only contains from a few thousandths to one hundredth of its own weight. The plant soon exhausts the small amount of soluble matter contained in arable land, but this matter is daily renewed by the chemical action of sunlight, and the various natural agents cause a sort of digestion to take place in the soil, converting insoluble into soluble bodies. The fertility of the soil is not shown by the amount of nutritive matter that it can dissolve at a given moment in water, but by the amount of matter it contains that with time will become soluble. We should, therefore, remember in applying liquid fertilizers that they should be largely diluted if we would imitate the natural conditions of vegetation.

All roots possess an elective power of absorption, as they will only absorb those substances that are suitable to nourish them, and reject all others. Each plant, so to speak, follows a diet appropriate to its own organization and character, and generally when the soil does not contain the necessary elements the plant, instead of adapting its chemical condition to that of the soil, will suffer and prematurely die.

We do not yet fully understand the mechanism of this elective absorption, but we are sure that the force of endosmose enters largely into the phenomenon. This force is shown in the following experiment:

Take a glass bottle (see Fig. 1) from which the bottom has been removed and replaced by some vegetable or animal membrane, fill it with some uncrystallizable solution, such as gum arabic, and close it with a cork, in which is inserted a glass tube open at both ends. If this apparatus is placed in pure water the solution gradually mounts in the tube, proving that the water has penetrated through the membrane and augmented the volume of liquid in the bottle. This property of membranous tissues, by which liquids of unequal densities are enabled to percolate through it and intermix, is called the force of endosmose, and was first observed by Durochet. The instrument that exhibits and measures the force is the endosmometer. The cells of the root act toward the soil and in regard to each other as minute endosmometers; and formerly it was assumed that the force of endosmase was the only power that introduced the water from the soil into the root, and caused its circulation through the plant. But this explanation is insufficient, because during the summer, when the circulation of the sap is the most rapid, the cells of the plant contain gas, and consequently are not perfect endosmometers.

Fig. 1.



But if the causes of absorption by the roots are obscure, its effect is well known, for we have observed that the power which forces the sap upward into the tree is very great, and can easily be measured by a "mercurial manometer."

This is a glass tube, in the form of a *v* (see Fig. 2), with unequal ends, both of which are open. The shorter end is enlarged in the middle so as to form a small reservoir, and is bent at right angles. If mercury is poured into the tube, until it half fills the reservoir, the mercury will remain at the same level on both sides.

If we wish to know the force of the sap as it rises from the root into the trunk, we cut the latter close to the ground and inclose the end of the stump in a glass cylinder, in one side of which is inserted the small end of the manometer. Fill the cylinder with water and lock it. When the instrument is thus arranged, the varying pressure of the sap is indicated by the rise of the mercury, and it is easy to calculate the exact force.

The pressure of the sap at different heights can be known by simply inserting the manometer in the side of the tree, as shown in Fig. 4.

Numerous observations have proved to us that the propulsive force of the roots, like all vital forces, is subject to variations produced either by external or internal causes.

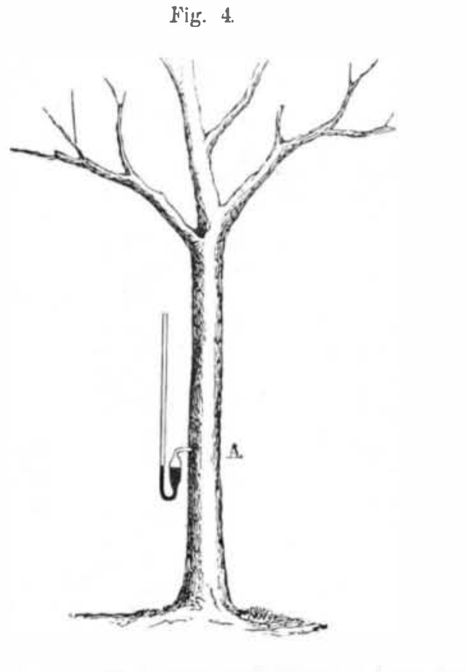
Fig. 2.

Fig. 3.

The strongest pressure observed by Hules (April, 1725) was equivalent to three-tenths of an atmospheric pressure. Since then still stronger pressures have been observed, in some instances to the pressure of one and a half atmospheres.

The propulsive force of the sap occasionally produces a curious phenomenon called the oozing sap. A little drop resembling pure water collects on the end of the leaf, and gradually enlarges till it falls, and is replaced by another. This takes place intermittently, and generally during the night or after a copious rainfall.

Fig. 4.



This phenomenon of the oozing sap can be artificially produced by forcibly injecting water into the bark of the tree. Soon after, drops of water will be seen issuing from the surface of the bark.

Fig. 5.

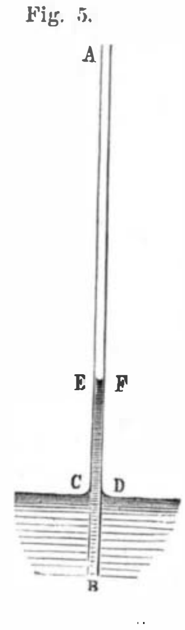
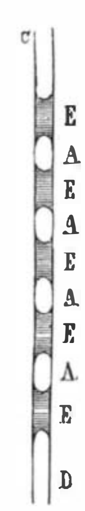


Fig. 6.



Sometimes this propulsive force suddenly disappears, and gives place to the opposite force of absorption, as may be seen in the following experiment. If, at the close of a warm summer day, when its transferation has been abundant, the plant is cut down to the ground, and a glass cylinder full of water fastened on the stump, the water will be seen to gradually diminish and disappear. The root will absorb it through the cut surface, just as a branch will absorb through its lower section when it is placed in water. In each case the cause is the same, the insufficiency of water in the tissues of the root or branch

The varying operation of these two forces can be seen by a manometer inserted in the tree. In the morning the mercury descends in the longer side of the instrument, thus showing the absorbing force of the tree, and later, again changes its level and registers the opposite force, which increases during the day, especially if the rays of the sun fall on that side of the tree where the manometer is inserted.

Capillary attraction is another motive force in the circulation and movement of the sap. The most familiar illustration of this force is to take a very small glass tube and plunge one end of it in water. The liquid will immediately rise in the tube above the level of the surrounding water, to a height proportionate to the diameter of the tube, and the smaller the diameter the higher the liquid will mount.

It is generally admitted that capillary attraction is one of the principal causes of the ascension of the sap. Still it is necessary to recollect that during the period of the most rapid movement of the sap, the veins and fibers do not contain unbroken columns of water, but are filled alternately with drops of water and bubbles of air, and later in the season only with air, as shown in Fig. 6.

The capillary phenomena in the plant are of a complex nature, and vary according to the time of the year, and heat, especially solar, dilates the interior gases of the plant, and by increasing their elastic force exercises a great influence on these phenomena, for the sap always percolates more abundantly through the insertions made in the tree when the sun falls warmly upon it.

IMPROVED GAS BURNER.

The accompanying engraving represents a new form of gas burner invented by Dr. McGeorge. It is claimed that it is very economical in burning gas, and secures complete combustion. It is well known that ordinary burners, because of imperfect combustion, throw off a great deal of poisonous carbonic oxide and carbonic acid gas, which vitiates the atmosphere very rapidly. The burner shown in the annexed engraving secures a more perfect combustion of gas, and thus diminishes the formation of poisonous gases, and at the same time, as shown by careful tests, an increase of fifty per cent in illuminating power secured by perfecting combustion alone, the quantity of gas consumed remaining the same.

In this gas burner, which has been named the "focus gas burner," two small side jets are directed to a point at the base of the flame, throwing heated gas mixed with air. By this means the gas is greatly rarefied and expanded, and an additional amount of oxygen is conveyed to the flame. The particles of carbon or blue portion of flame (the gas being superheated) are reduced so as to eliminate the greatest amount of light. This more perfect combustion also checks the outflow of carbonic acid gas.

Gas, like steam, admits of expansion by heat to almost any limit. The more the particles are heated and separated, the more perfect combustion is secured, and a larger proportion of light is produced.

If a regulator is used, a sufficient pressure is given through it to carry the burner to complete combustion. This pressure is offset in the "focus burner" by a novel check, which is very simple and effective. No complicated valves nor inside apparatus, which are liable to become smutty and fill up, are used.

The inventor gives the following photometric test, made in May last, at one inch pressure: A common burner, placed upon the test, gave an hourly consumption of 2 feet; light emitted equal to 6 star candles. The "focus burner," with the same amount of gas; light emitted equal to 11¾ candles.

Further information may be obtained from J. C. O. Redington, General Manager, 27 Park Place, New York.

Telegraphy Between Australia and London.

On the 1st of October last, a message of sixty-nine words was forwarded by the Governor of Victoria announcing the opening of the Melbourne Exhibition on that day. The message was dispatched from Melbourne at 1 P.M., and reached London at 3:43 A.M., on the same day, or 9 hours 17 minutes before the hour of its despatch. Allowing, however, for the difference of time between the two cities, it occupied only twenty-three minutes in transit. The route of the message was over the lines of the Victorian and South Australian colonies, the cables of the Eastern Extension, Australasia, and China Telegraph Company, the lines of the Indian Government, the cables of the Eastern Telegraph Company, and the lines of the Egyptian and French Governments, and the rapidity of its transmission shows the harmony with which these various administrations work together. The total distance traversed was 13,398 miles.