SERPULAS, OR SEA WORMS.

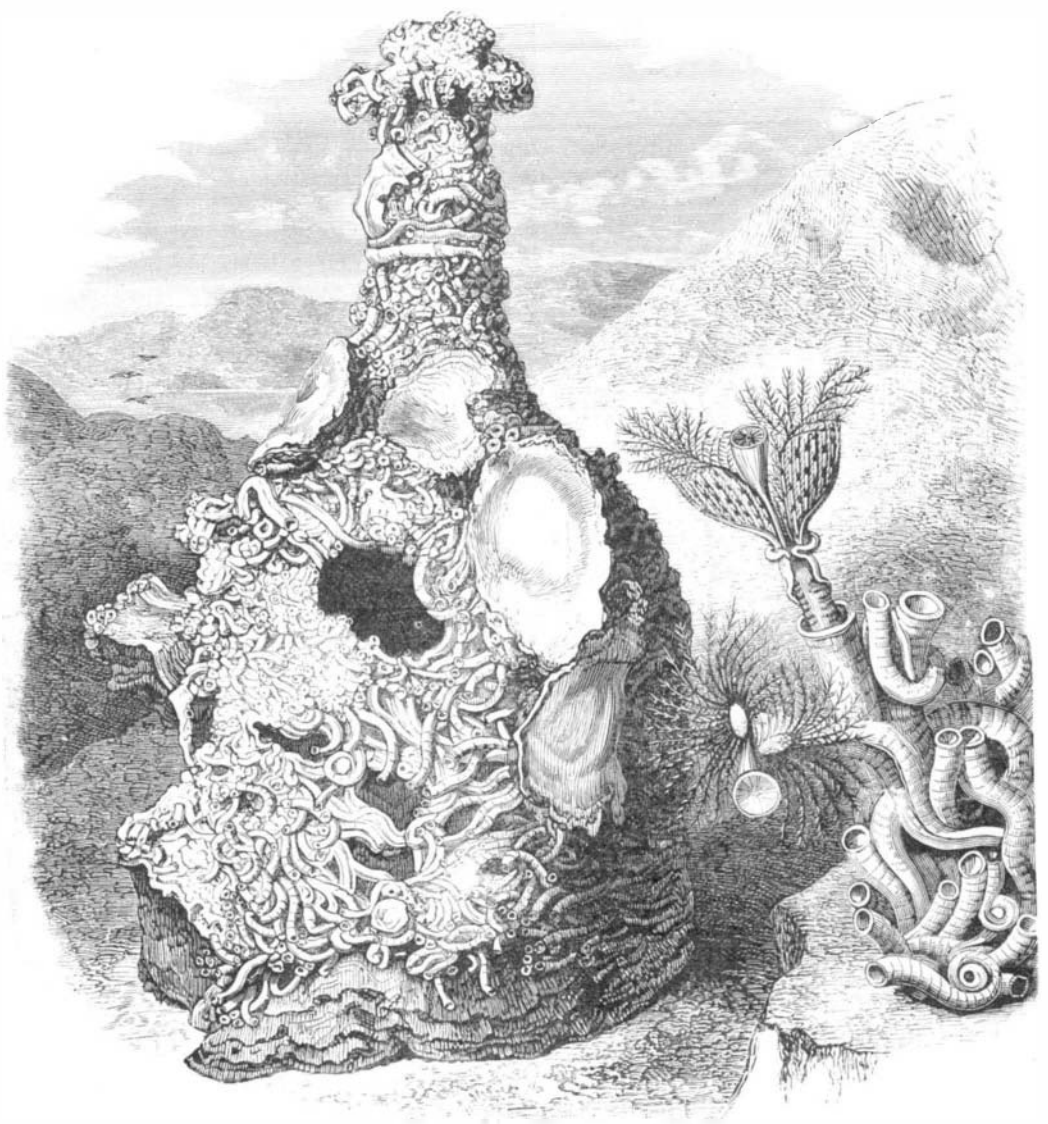
The rambler along the sea shore will not unfrequently meet with shells, stones, and other objects that have long been immersed in the waters of the ocean, more or less incrusted with masses of white, calcareous tubes, which, from their writhing forms, at once suggest to his mind the idea of worms. The old bottle, covered with these familiar objects, shown in the annexed illustration, will perhaps recall a forgotten subject to the mind of many a reader. These elongated, variously twisted tubes, popularly supposed to be "petrified worms," constitute the dwelling places of certain small marine worms called *Serpulæ*. In the animal kingdom these little creatures have their place in the lowest class of Articulates. This class, the *Annelida*, embraces an extensive series of animals usually grouped together under the common name of "worms," and comprehends four orders, as types of which we may take, for instance, the (1) sea centipede, (2) the leech, (3) the earth worm, and (4) the marine worm (*serpula*). This class is remarkable as being the only section of invertebrate animals which possess red blood. The worms belonging to three of these orders are erratic, but the fourth (whose type is the *serpula*) includes creatures which inhabit a fixed and permanent residence that serves to inclose and protect them from external injury. This is generally an elongated tube, varying in texture in different species. Sometimes it is formed by agglutinating foreign substances, such as grains of sand, small shells, etc., by means of a secretion which exudes from the surface of the body and hardens into a tough membranous substance, as in the case of the *Terebella*. In other cases, as in *Serpula contortuplicata* (the species shown in the engraving), the tube is homogeneous in texture, formed of calcareous matter, and apparently secreted in the same manner; for this reason the tube keeps increasing in length and diameter as long as its inhabitant continues to grow, the formation of this protecting sheath being the progressive work of the entire life of the animal. The elongated body of these worms is divided into numerous rings, and its anterior portion is spread out in the form of a disk armed on each side with bundles of coarse hairs; in this disk is the mouth opening.

From the sides of the mouth arise the fan-shaped respiratory tufts (shown in the enlarged figures to the right of the illustration), forming most elegant arborescent appendages of a beautiful red color, mixed with yellow and violet, and exhibiting when expanded a spectacle of great beauty. In some species (as in the one illustrated herewith) there is a remarkable provision made for closing the tube when the worm retires within its cavity.

On each side of the mouth of the worm is a fleshy filament resembling a tentacle; but one of these, sometimes the right, sometimes the left, is found to be considerably prolonged, and expanded into a funnel-shaped operculum or lid, which accurately fits the orifice of the tube, and thus forms a sort of door, well adapted to prevent intrusion or annoyance from external enemies.

It has been shown by experiment that if these little creatures be taken from their shell, or the latter be destroyed, they make no attempt to form another, having lost either the faculty or the instinct of doing so.

As it is in the nature of serpulas to live in numerous colonies, we usually find their tubes agglomerated into compact masses on all kinds of submarine objects, about which they bend and twist themselves in all sorts of shapes. The curious bottle, the shape of which is so well preserved through the mass of serpulas and oyster shells which incrust it, is among the specimens in the Museum of Natural History, at Paris.



SEA WORMS OR SERPULAS INCRUSTING AN OLD BOTTLE.

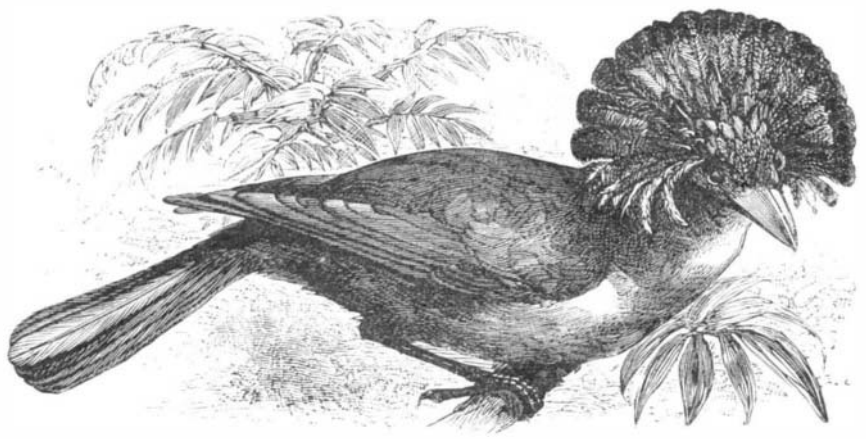
[The figures to the right show the animals enlarged.]

KING TODY.

The singular and beautiful bird which is known by the name of King Tody, or Royal Great Crest, is a native of Brazil, and may challenge competition with many of the flycatchers for elegance of form and beauty of coloring.

It is a very rare bird, to all appearance but little known in its native land. This species is chiefly remarkable for its splendid crest, which is capable of being lowered upon the neck, or raised almost perpendicularly, in which latter position it assumes a spreading and rounded form, like an open fan.

The feathers of the crest are long and slender, and spoon-shaped at their extremities. Each feather is bright chestnut-red for the greater part of its length, a narrow stripe of rich orange succeeds, and the tip is velvet-black, encircled by a band of steel blue. As may be supposed, the effect of its spread crest is remarkably fine and striking. The upper parts of the body are dark chestnut brown, rather deeper on the quill feathers of the wings. The throat, chest, and abdomen are pale fawn, warming towards chestnut on the central line. The total length of this bird is six inches and a half. We take our illustration from Wood's "Natural History."



KING TODY.

The Formation of Quartz.

A San Francisco engineer and metallurgist, J. Mosheimer, writes to the London *Mining Journal* as follows:

A further proof of the formation of quartz from aqueous solutions has presented itself in a steam boiler in use in one of the Nevada mines. A boiler of four feet in diameter and provided with five flues had been in use for some years; but little attention had been paid to cleaning it or blowing it off, as it is called, and a sediment accumulated until it reached the first two flues. The whole of the interior was heavily incrusted, and as it conducted too little heat the boiler had to be replaced by a new one. After cutting the former to pieces my informant, Mr. E. Watkins, M. E., found a heavy incrustation all around the inside. At the bottom of the boiler a soft sediment was found, which was overlaid by another hard crust. The flues were incrusted on top with silicate of lime, and had at the bottom a coating of solid transparent crystals of quartz; the crystals were of rhomboidal shape, about one half inch in length, and as perfect as any other natural quartz crystals. The formation of quartz crystals of considerable size in boiling water in but a few years leads me to the belief that the large quantities of granulated quartz which were found in early days in the burning Moscow mine, on the Comstock lode, were of the same origin.

Quartz may thus be decomposed and made soluble by the action of steam in combination with an alkali, and then used as soluble silicate.

Fragarine.

Dr. T. L. Phipson finds in the root of the strawberry several substances closely allied to some which are contained in the cinchona barks. One of these is a compound very similar to quinovine; another, which he calls fragarianine, from the botanical name of the strawberry is a kind of tannin closely allied to quinotannic acid, but, instead of yielding cinchona red like the latter, it yields a somewhat similar substance called fragarine. To obtain the latter about 50 grms. of the strawberry root, in thin slices, are left for forty-eight hours in a stoppered bottle, with water acidulated with about 5 per cent of hydrochloric acid. The solution filtered off is of a pale golden-yellow color; it is strongly acidified by addition of more hydrochloric acid and boiled for an hour or two. As the temperature rises towards the boiling point the pale yellow liquid becomes darker and redder, and finally takes a splendid orange-red color. On boiling it becomes cloudy, and after some time fragarine is abundantly precipitated in flocks of a reddish-brown color. After allowing the liquid to become quite cold it is filtered, and the new substance collected is washed with cold water. The filtered liquid contains glucose.

Fragarine thus obtained has the following properties: It is an amorphous reddish brown powder, highly electrical by friction, soluble to some extent in water, alcohol, and ether, dissolving in potash with a fine reddish purple color. It dissolves in concentrated sulphuric acid, and forms a conjugated acid the solution of which is brownish-purple. Boiling hydrochloric acid does not affect it. Treated with nitric acid it forms a brilliant yellow nitro-compound, different from picric acid, yielding no picramic acid when reduced by sulphide of ammonium. Chlorate of potash and hydrochloric acid mixture yields a bright yellow chlorine compound, insoluble in water, decomposed by ammonia.

Heated in a tube fragarine yields water, is decomposed without fusion, depositing much carbon, and producing a white volatile substance which condenses in the tube and is soluble in water; the solution produces a green color with salts of iron; it is probably pyrocatechin. Melting hydrate of potash decomposes fragarine with production of dark brown substances and a little protocatechuic acid, which can be isolated by ether from the acidulated solution of the products of this reaction, and also colors iron salts green.

While fragarine is being produced by boiling with hydrochloric acid as above, there is diffused through the laboratory a very agreeable odor of essence of cedar. When the same experiment is made with an acid decoction of red and yellow cinchona barks (obtained in the cold) there is produced an odor of heated spermaceti. It is curious that both essence of cedar and cetene of spermaceti contain 32 equivalents of carbon. Instead of giving a dirty green color with potash, as cinchona red does, fragarine dissolves with a reddish or brownish purple color. This is the best way of distinguishing between these two substances.

The Stiffening of Plant Stalks.

The presence of silica in the stalks of grain has long been claimed as a proof of design in the structure of such stalks. The soft fiber of the growing grain would not be stiff enough to support the head; accordingly a stiffening of silica was added to the outside. Chemical analysis has shown, however, that at the time when the stalk most needs stiffening it does

not contain a hundredth part of silica. Professor Caldwell of Cornell University derides the idea that so small a percentage of a very brittle substance like silica could add toughness to a stalk; and shows that the results of experiments demonstrate the absurdity of the idea.

He says, in the *Tribune*, that, though nearly three fourths of the ash of wheat stalks, for example, is silica, it is found that "this apparently large proportion of silica is not in the stem itself, but mostly in the leaf, including that part of it which forms a sheath about the stem; this loosely attached sheath can evidently bear no part in supporting the head. Secondly, it has been repeatedly shown that perfect plants of wheat, rye, oats, or Indian corn, with stems of all the usual strength, can be grown in media containing no silica, and that there was none of the substance, or merely a trace of it, in the ash of the plant—only what it took up from the small quantity that was dissolved out of the walls of the glass vessel in which the plants were raised.

"Thirdly, it is well established, by these and other researches, that the strength of the stalk does not depend on any of the ingredients of its ash, or of the mineral matters that it takes from the soil, and that the weakness of the stalk that causes the grain to lodge is not the result of any peculiarity in its chemical composition. This weakness is rather the consequence of an abnormal mode of growth of the cells in the lower part of the stalk, where strength is most needed, these lower internodes, by reason of a deficient exposure to light, stretch themselves out and grow to an unusual length, and the cell walls are found to be unusually thin, and are therefore weak. This weakened condition of the stalk has been produced artificially by surrounding it with a tube of clay or other opaque material; and on comparing a stalk thus grown with some stalks of lodged wheat, the same unusual spindling form and thinness of cell walls were to be seen in both. Fourthly, Velter tested the comparative strength of small bundles of wheat stalks, from a plat that had been thinned out so as to admit light and air freely, of some wheat that grew thickly together, and of some that had been manured with a soluble silica compound in addition to its regular food: the first was the strongest, and the last the weakest of the three."

The Contortion of Rocks from Heat Mechanically Generated.

M. Daubrée, the eminent director of the School of Mines of Paris, in a paper read before the French Association, in August, says that one of the most remarkable characters of the rocks which have undergone mineralogical transformations, comprised under the name of "metamorphism," is that the rocks thus transformed are often associated, occupying together considerable territory, while other regions, still more extensive, do not present like modifications. These transformations, in all probability, have taken place under the influence of an elevated temperature; and while they are partially due to heat from the depths of the earth, there is a cause for them which is more immediate and more general, that is, heat produced by mechanical actions, that have left their traces in the bendings and foldings of the strata. M. Daubrée, after a series of experiments on the heat produced in rocks by interior movements, draws the following conclusions: (1.) The rocks were already in a solid state at the period when they followed the action which contorted them; (2.) Many of these rocks during these movements acquired a laminated structure; (3.) Certain effects of regional metamorphism may be derived simply from the heat which has been developed in the rocks by mechanical action; (4.) Fossils have been destroyed by trituration in the interior movements of such rocks as have become changed in texture or assumed a crystalline state.

"Finally," says M. Daubrée, "in rock masses where metamorphism has been developed on a great scale, and far from any eruptive rock, the heat which has presided over the transformation of the rocks, and the appearance of new species of minerals, may have been caused by the very mechanical actions which these rocks underwent."

Balata Gum.

From an article written by Dr. W. Riegler, published in the *Wochenschrift des Niederoest. Gewerbe-Vereins*, we gather the following information regarding this new article of commerce, which promises to become of considerable importance in view of the ever-increasing demand for India rubber, and the rapidity with which the trees that produce both the latter and gutta percha are necessarily being destroyed. Balata is a product of the *Mimusops balata* (Nat. ord. *Sapotaceæ*), a tree of large dimensions growing on the banks of the Orinoco and Amazon, in South America. The milky juice is procured, like caoutchouc, by incision of the trunk. It dries very quickly on exposure to the air if the atmosphere is dry, and can be readily moulded into shape by first being softened in water. This gum, in its general properties, appears to be of a character intermediate between India rubber and gutta percha, possessing the elasticity of the one and the ductility of the other, without the intractability of India rubber or the brittleness of gutta percha. It is tasteless; heated, it diffuses an agreeable odor, and can be cut the same as gutta percha. Heated to a temperature of 120° Fah., it becomes soft and capable of being welded. Its melting point is 270° Fah., a temperature much higher than that necessary to melt gutta percha. It is entirely soluble, cold, in benzole and bisulphide of carbon. Under the action of heat it is likewise soluble in turpentine; in anhydrous alcohol and ether, however, it is but partially so. It is acted upon by neither the caustic alkalies nor concentrated hydrochloric acid; but, like gutta percha, it is attacked by concentrated sulphuric and nitric acids. Subjected to friction it becomes very electrical. It is probable that it will be extensively employed as an insulating medium for telegraphic purposes, for which its superiority over gutta percha has already been proved by trial. In balata, says Dr. Riegler, we have an article that gives promise of being of the highest utility; not so much on account of its possessing new properties, as because it is a new member of a group of the useful elastic gums; and which, occupying, as before remarked, an intermediate place between caoutchouc and gutta percha, may become under certain circumstances more valuable than either of these substances.

The Torrey Botanical Club.

At the regular meeting of the Torrey Botanical Club, held at Columbia College, on Tuesday, October 8, the president, Dr. Geo. Thurber, exhibited a number of interesting American and foreign plants of his own cultivating. Among the latter were *Andropogon schœnanthus*, or lemon grass, a species of grass which grows abundantly in India, Ceylon, and the Moluccas, and from the fragrant leaves of which is distilled an essential oil largely used in perfumery; and also an ornamental striped grass from Japan (*Ularia Japonica*), one of the varieties of which presented a curious example of cross variegation.

Mr. Leggett called attention to the fact that *Monotropa hypopitys* exhibited two very different forms; the one occurring in the early part of the season (June) being pale yellowish and odorless, and the other, appearing in August, being reddish and quite fragrant. He asked whether these two diverse forms had been properly investigated, and whether it might not be possible that they were different species.

The vice-president, Mr. A. Brown, made a valuable contribution to our present knowledge of the flora of this vicinity in the form of a list, accompanied by specimens, of over fifty species of plants that have not been hitherto reported. Most of these plants were found growing on a vacant lot near the depot of the New Jersey Central Railroad, at Jersey City, where they had apparently been established for years. Twenty-two of these plants are not recorded in our manuals of botany, and are from foreign countries, probably having been introduced from the ballast of ships. Of the remainder, many are from the South and West. One specimen, apparently an exotic composite, has not yet been determined. The list was placed in the hands of the editor of the *Bulletin* for publication.

One of the members reported plum trees in flower at the present time on Staten Island, and exhibited specimens. The president remarked that such an occurrence was not uncommon, especially in a certain kind of harvest apple. The late fall-flowering of the horse-chestnut in the city parks has been noted by the members for several years past, and many times reported at the meetings of the club.

In an ensuing discussion on some of the *Nymphæaceæ*, the question was asked, What is the use of the mucilage investing the stems of *Brasenia peltata*, in the economy of the plant? The president suggested that this was an interesting subject for investigation, and suggested that the members look into the matter and report at the next monthly meeting.

Immense Labor Performed by Bees.

Nectar is the term applied by botanists to the sweet tasting fluid which is secreted within the cups of flowers; and the object gained to plants by its presence is that insects, induced to visit flowers for its sake, are useful to the plants by effecting a cross fertilization, an additional amount of vigor being thus conferred on the seeds which subsequently result, in contrast with the evil effects produced by continuous "breeding in and in." The formation of nectar is observed to take place most freely in hot weather, and to be prevented by cold or wet. So great economy is exercised by the plant that it is only formed at the time when insects' visits would be beneficial, that is, when the anthers are ripe and shedding their pollen, or when the stigma is mature and ready to receive pollen. By biologists the visits of bees, butterflies, and other insects are believed to have exercised in past time an important influence in modifying the size, shape, color, etc., of flowers. Nectar is of course the source whence bees derive honey, but it also affords food to many kinds of insects which do not possess the same habit as the former of storing it up. Professor Alexander S. Wilson, of Glasgow, has recently investigated the amounts of sugar contained in the nectar of various flowers, and laid the results of his labors before the British Association. He extracted the nectar with water, and determined the sugar before and after inversion by means of Fehling's copper solution. From his table of analyses, which for our present purposes it is unnecessary to reproduce here, we select clover as an example. He found that, approximately, 100 heads of red clover yield 0·8 gramme of sugar, or 125 give 1 gramme (16 grains), or 125,000 1 kilo (2¼ lbs.) of sugar; and as each head contains about 60 florets (125,000×60), 7,500,000 distinct flower tubes must be sucked in order to obtain 2¼ lbs. of sugar. Now as honey, roughly, may be said to contain 75 per cent sugar, we have 1 kilogramme (2¼ lbs.) equivalent to 5,600,000 flowers in round numbers, or, say, two and a half millions of visits for one pound of honey. This shows what an amazing amount of labor the bees must perform, for their industry would thus appear to be indispensable to their very existence.

The Big Trees of California.

Professor W. H. Brewer, of Yale College, an eminent authority on matters pertaining to the botany of California, writes to the *New England Journal of Education* to correct some errors made by a correspondent of that paper in regard to the "Big Trees of California"—errors which are constantly creeping into the papers, although they have often been refuted. He says:

The first error relates to their height, the second to their age.

If only the truth be told, they still remain the grandest trees on earth, and one of the wonders of the world. Some of the Australian *Eucalyptus* trees exceed them in the matter of height, yet, take them all in all and as they are, the giant *Sequoias* are the greater. Your correspondent tells of "The Father of the Forest" being "about four hundred and fifty feet high when in his glory," as if this was a proved fact rather than a vague guess. The fact is that no one knows how high it was, for, when the grove was first discovered by white men, the prostrate tree was already partly rotten and the whole top burned away; and accounts published twenty-four years ago speak of the tree as perhaps over 400 feet high when living.

The State Geological Survey carefully measured all the higher standing trees in this grove, in the Mariposa grove, and some of the trees in the other groves, and published the result years ago. In the Calaveras grove there were then 27 trees of 250 or more feet, four of which were 300 or more feet, the highest being 325 feet. Over 300 trees were measured in the Mariposa grove, the tallest of which was 272 feet. The only other tree I have seen which rivals "The Father of the Forest" in diameter is in the King's river grove, and was less than 300 feet high. There is no evidence that "The Father of the Forest" (or any other *Sequoia*) ever reached 350 feet, and what its height actually was can never be known.

Next as to the age. The first extended description, published in Europe twenty-five years ago, "estimated" the age at several thousand years, and gave wings to the imagination as to the events in the world's history which the old trees had seen in their life-time. This error has been refuted from year to year, for I know not how long, for every scientific investigation has shown its fallacy; but the first story was so well told, and seemed so marvelous, that it is repeated by the majority of "correspondents" in some form, and I am sorry to say that clergymen and teachers are not the least common offenders. It is so much easier to repeat a startling story than it is to test its accuracy, that it is probable future generations of correspondents in 1978 will continue to tell how large this or that tree was "when Paris carried Helen from the walls of Troy." And so your correspondent speaks of one still standing as "a tree that began its growth long before David reigned in Israel!"

We know the actual age of only one of the larger trees of the Calaveras grove, and that is the tree your correspondent tells us of as having been felled in 1853. That tree was sound to its center, and we know its age to within a very few years, and it began its growth more than twenty-five hundred years after David died. It is possible that some of the oldest trees of this species may have begun their growth over 2,000 years ago, but not at all probable that any reached back to within a thousand years of the time of David.

The Use of Snails in Medicine.

While snails are no longer an article of materia medica, says the *Pharmaceutical Journal*, they are occasionally used in England, boiled in milk, as a popular remedy in diseases of the chest, simply, perhaps, for the reason that their mucilaginous properties are looked upon as likely to prove beneficial. But although snail soup is usually suggestive of the ludicrous to the English mind, M. Baron Barthélemy maintains that snails are capable of rendering valuable service in most chest complaints, bronchitis, asthma, etc., because, in his words, they contain "animalized sulphur, a little phosphate of lime, and especially carbonate, animalized, in solution, and in a nascent state in their mucilage." The preparations he exhibits, at the Paris Exhibition, are "Snail Sirup," "Snail Bonbons," and "Helicine," as mucilage and powder. For these the edible snail (*Helix pomatia*) is used, collected in the vineyards in the south of France (preferably in the months of August and September), and carefully preserved and fed during the winter. M. Barthélemy lays great stress on this feeding, and attributes the reason that these snails are not more generally used as an article of diet to the fact that their flavor is only properly developed where they obtain suitable food, as, for instance, in the vineyards of the south of France and Italy. However this may be, and whatever may be thought of the chemistry of the subject, it is certainly the fact that when this very mollusk was a tidbit of the Roman epicure, it was, before being cooked, fattened in the *cochlearia* by means of a paste composed of meal and wine.

M. BUCHNER, a French scientist, has discovered that a single drop of alcoholic extract of Campeachy wood, placed upon pure flour or bread, will cause a brownish yellow stain. If the flour contains alum, in the proportion of one or two per cent, the color will turn to a grayish blue or violet gray. With one half per cent of alum the tint is reddish yellow, with a border of gray blue, and small blue spots can be discovered by examining it with a lens. One fourth per cent of alum is the limit of reaction, when the blue border disappears, although the small spots are faintly discernible.

Notes & Queries

(1) G. S. Y. writes: Is the manufacture of sugar from the beet root a success? Are there any factories for its manufacture in this country, and if so, where located? A. Consult the SCIENTIFIC AMERICAN SUPPLEMENT, pp. 1947, 1963, 1324, 1032, and SCIENTIFIC AMERICAN, p. 169, vol. 37.

(2) A. F. B. asks: 1. Was there a good and sufficient reason for basing our system of numeration upon 10 rather than 12 parts? If so, what? A. The decimal system is not the best; but it is historical, founded on the circumstance that we have ten fingers and not twelve, or any other number. 2. What sufficient reason is there for spelling contrary to pronunciation? A. No reason but custom. 3. Are any or all of the other branches equally faulty? A. All human devices fall short of ideal perfection.

(3) J. M. McC. asks: 1. What are the capabilities of a rather strong medical magneto-electric machine? Can I magnetize with it iron and steel and make magnets strong enough for a telephone; or strong enough to serve as magnets in a larger magneto-electric machine? Can I electroplate with it? A. Your machine is not suited to any of the purposes named. 2. By what rule can I calculate the size or length of wire required in the bobbins for a magnet of given size? A. The amount of wire varies with the use to which the magnet is applied. 3. What battery would be best for a good medical galvano-faradic machine—how many pairs? A. An ordinary sulphate of copper battery, or two small cells of Marié Davy sulphate of mercury. 4. What size of induction coil? A. See p. 203 (14), current volume of SCIENTIFIC AMERICAN.

(4) S. B. T. asks (1) for a recipe for making glue to fasten leather to iron, in order to cover iron pulleys. A. 1 part of crushed nutgalls is digested 6 hours with 8 parts distilled water, and strained. Glue is macerated in its own weight of water for 24 hours and then dissolved. The warm infusion of galls is spread upon the leather, the glue solution upon the roughened surface of the warm metal; the moist leather is pressed upon it and then dried. 2. Also a good dressing to make rubber belts adhere to pulleys. A. We think you should use wider belts or larger pulleys if the adhesion is insufficient. It is a good plan to occasionally wash the worn surface of rubber belts with soap and water. 3. Also a glue for sticking leather to leather at splices. A. See recipes on p. 187 (5), in current volume.

(5) I. H. A. writes: I have been making a mercurial barometer. Can you tell me how to proceed to set the scale? A. Zero of your scale is at the level of the mercury in the cistern. The scale simply indicates the height in inches of the column of mercury contained by the tube.

(6) H. I. writes: A. says the whole working power of steam can only be obtained by an uninterrupted flow of steam from the boiler into the cylinder. B. says the same amount of power can be obtained if the steam comes from the boiler in puffs, provided these puffs are sufficiently rapid (say ten puffs per second). Who is right? A. We think it might be possible, theoretically, to obtain the whole power with either system.

(7) T. B. O. asks for a recipe for a walnut stain. A. Water, 1 quart; sal soda, 1½ oz.; Vandyke brown, 2½ ozs.; potassium bichromate, ¼ to ½ oz.; boil for ten minutes, replacing the water lost by evaporation. Use hot, and allow the work to dry thoroughly before oiling or varnishing.

(8) M. T. writes: 1. In the SCIENTIFIC AMERICAN of August 24 you give the plan of a simple phonograph, but you do not tell what proportions to make it by. How large should the mouthpiece be? A. 2¼ inches external diameter. The small aperture ½ inch diameter. 2. What size should the diaphragm be? A. 2¼ inches, leaving a portion, 1¾ inches diameter, free to vibrate. 3. What would make a good spring? A. Wood, steel or brass. 4. Will the machine work perfectly when properly made? A. Yes, with careful management. 5. What should the body of the instrument be made of? A. Wood of almost any kind. Mahogany, we think, would be best.

(9) E. E. writes: I want to make a Prussian blue that will dissolve in water. I have made a blue, but it is insoluble. A. Mix 1 lb. of the dry blue with a little hot water to form a paste, and triturate this with about 1½ oz. of potassium ferrocyanide (yellow prussiate).

(10) J. L. S. asks: What is the best polish for cleaning the end of the cylinder, and caps that fit over the end of the cut-off? A. One of the best is tripoli, applied with a piece of flannel and a drop of oil. If the metal is very dirty, use first fine emery or emery flour and oil. In some cases it is preferable to use first a little emery moistened with solution of oxalic acid in 5 or 6 parts of warm water.

(11) F. H. D. asks: Did you ever know the water to leave the gauge glass entirely after the fires had been banked under the boiler and the steam pressure gone down of its own accord? What is the cause of its doing so? It is a case that has come under my own personal observation, all the valves being shut at the time; when on opening the gauge cock and air being admitted the water will return gradually, until the water resumes its proper level in the boiler. A. It is not uncommon for water to fall in the gauge when steam goes down, and the boiler becomes comparatively cool; but in the case mentioned by you, as the water shows on the admission of air, we are inclined to think that the connections between the gauge and the boiler must be partly closed, and that there must be a small leak in the gauge through which air could enter as a vacuum formed in the boiler. Air entering the boiler through the gauge in this way would carry the water with it.

(12) H. D. H. asks: What is the intrinsic value of gold per ounce, both 14 carat and 18 carat fine? A. Coin value of fine metal 20·67 per troy ounce; 14 carat $\frac{14}{24}$ and 18 carat $\frac{18}{24}$ of this value.

(13) G. W. B. asks if forest leaves will answer for filling between the two walls of an icehouse built above ground. A. If the leaves are thoroughly dried, broken, and not too closely packed, they will answer the purpose very well. Sawdust, however, is considered preferable.

(14) E. P. writes: I am making a medicine (of which I am not the inventor; however it is a secret). Can I sell it, or must I have a license? A. If the medicine is not patented, we think you may sell it.

1. SCIENTIFIC AMERICAN, vol. 39, p. 171 (2), contains a recipe for a silver solution. I made it so, but took too much potassium cyanide to settle the silver nitrate, which produced a white foam. What is that foam, and what does the liquid contain? Can it be used yet, and how? A. If the water used was free from chlorides, the white body is silver cyanide. Dilute the mixture somewhat with warm water and let it stand, when the precipitate will settle. If too much potassium cyanide has been added, the supernatant liquid will give a fresh precipitate on addition of more silver nitrate. To prepare silver cyanide the proportion should be 85 parts of silver nitrate to 33 parts of dry potassium cyanide. 2. How much potassium cyanide for 1 gallon solution would you recommend? I have a few recipes which differ from 1½ to 8 ozs. A. The precipitate requires for its proper solution at least 33 additional parts of potassium cyanide dissolved in water. Electroplaters' baths usually contain much free potassium cyanide—water, 1 gallon; potassium cyanide, 9 to 12 ozs; silver cyanide, 1 oz. 3. How can I make a silver solution for a bright deposit? A. We know of nothing that will obviate the necessity of burnishing; polishing is not always necessary. It is said that a little sulphuret of carbon added to the plating solution prevents the chalky appearance and gives the deposit the appearance of metallic silver. 4. Does gold plating need any polishing? A. Yes.

(15) F. H. wishes to know what material is used to prevent rubber in vulcanizing from sticking to iron, brass or steel moulds. A. Soapstone (steatite) powder is used for this purpose.

Can you give me the address of some manufacturing firm where I can get iron such as used for tinning? A. From any large dealer in sheet iron.

(16) H. L. A. asks: What is the percentage of rosin oil in rosin? What is the residue, after the oil is distilled, used for? In what sort of stills is rosin distilled for oil making? A. When rosin is distilled it yields about 74 per cent of liquid distillation. The first portions, called essence of rosin, are yellow and strong smelling. Later in the distillation "pinolin," or rosin oil proper, passes over. The latter is used in paints, for the manufacture of printer's ink, in soap making and in cheap lubricators. The pitchy residue may be used for roofing and similar purposes. The stills may be constructed of iron.

(17) J. S. B. writes: In the September 7 number of the SCIENTIFIC AMERICAN you speak of "Mosso's plethysphygmograph." Please state what it is. A. It is the name given by Mr. Mosso to an instrument of his invention designed for observing the variations in the circulation of the blood in the arms, etc.

(18) W. H. B. asks for an electro silver plating solution; also what is the best mixture for removing grease, etc., from brass before plating. A. See p. 171 (2), current volume, SCIENTIFIC AMERICAN. To clean the brass dip it first in a strong boiling hot solution of caustic soda to remove grease, and (without touching) rinse with clean water, dip for a few moments in nitric acid diluted with two parts of water, rinse again and scour with fine clean sand and a stiff brush; then dip momentarily in the acid bath, rinse quickly, and transfer immediately to the plating bath.

(19) A. T. R. writes: At our temperance meeting recently there was a spirited discussion in reference to the composition of soda water, one man claiming that he could drink enough to produce intoxication; another claimed that its ingredients were wholly mineral, and therefore not intoxicating. A Common soda water is water supercharged with carbonic acid. It is not intoxicating. Some of the sirups used with it not unfrequently contain alcohol.

(20) A. T. J. asks: 1. What is the process for making artificial ice? A. There are several processes. See pp. 159 and 387, vol. 38, and 95, 168, and 335, vol. 37, SCIENTIFIC AMERICAN. Also pp 425, 507, 1159, 1430, and 1348, SCIENTIFIC AMERICAN SUPPLEMENT. 2. Will you please inform me of the name of some book which treats of the subject "Water," and that subject only. A. "Forms of Water"—Tyndall.

(21) C. K. asks how to fasten rubber on brass. A. Melt together in an iron vessel equal parts of pitch and gutta percha. Use moderately hot.

(22) E. W. E. asks: Is there any recipe to make cloth waterproof, and one to make it mildew proof? A. Pass the cloth slowly through a strong, boiling aqueous solution of yellow soap, and then digest for an hour or more in a strong bath of alum or lead acetate (sugar of lead) dissolved in water.

(23) F. G. H. asks: How can I make a good nickel plating liquid, and use it? A. Dissolve ¾ lb. of nickel ammonium sulphate, or 4 ozs. of the corresponding chloride, in a gallon of soft water. See article on nickel plating on p. 209, vol. 38, SCIENTIFIC AMERICAN.

Where can silk and cotton covered wire be bought? A. Of any dealer in telegraph and electrical supplies. See our advertising columns.

I saw somewhere that the saltness of the ocean and Great Salt Lake was owing to the water escaping only by evaporation. Is this true? A. The saltness is due to a greater loss of water by evaporation than otherwise.

(24) M. C. B. asks for a recipe for removing superfluous hair. A. See p. 107 (8), vol. 38.

Can you inform me how to give canvas a soft, black, waterproof coating that will not harden and crack off? A. Soften 2 parts of gutta percha with 3 or 4 parts of benzole by aid of heat over a water bath. Boil vegetable oil to the consistence of jelly, cool, and add 75 per cent of benzole. To seven gallons of this add three gallons of the gutta percha solution, and an additional gallon of benzole containing a sufficient quantity of lampblack, graphite, and boneblack to color.

(25) L. V. S. asks: Is there any substance known which will render copper more easily melted? If so, what is it? A. As we understand you, no.

(26) M. L. A. writes: 1. Two men pulling upon the ends of a rope in opposite directions, each one pulls 25 lbs. What is the strain on the rope? A. 25 lbs. 2. If one end is fast, and 25 lbs. weight applied on the other, what strain does the rope sustain? A. 25 lbs. + its weight.

(27) N. B.—See pp. 1326, SUPPLEMENT No. 83, and 48, current volume, SCIENTIFIC AMERICAN.

(28) A. I. asks for a good work which treats fully on the practical manufacture of Portland and other cements. A. Consult Reid's "Practical Treatise on Cements."

(29) I. E. P. asks: 1. Does any white lead used for painting or commercial purposes contain 98 per cent pure lead? A. No. Commercial white lead is a compound of lead carbonate and hydrate in variable proportions. In general the composition may be represented by the formula $2PbCO_3+PbH_2O_2$. 2. I get from a very fine article, after treating it with dilute nitric acid, a precipitate which does not entirely dissolve in muriatic acid, which would seem to show something besides baryta. What is it? A. It is frequently adulterated with barium sulphate (heavy spar), barium carbonate (witherite), calcium carbonate and zinc oxide, and sometimes with pipe clay or kaolin. Of these the first and last named substances remain as a residue after treatment with nitric and hydrochloric acids. The residue may also contain lead sulphate. 3. What is the best and most decisive test for white lead, and how can I ascertain the percentage of adulteration? A. See p. 269, Thorpe's "Quantitative Chemical Analysis."

(30) M. J. S. asks: 1. How can I separate small particles of emery gathered by means of an exhaust pan? We use wooden wheels covered with leather, upon which we glue No. 60 emery. The emery is still sharp, but cannot be used on account of the iron mixed with it. A. Use a magnet. 2. How can I cement leather to the periphery of an iron wheel, so that it will withstand continual jar, to be used as a buff wheel subjected to rough usage? A. Melt together in an iron vessel equal parts of pitch and gutta percha; roughen the iron and use the cement.

What is the best method for using exhaust steam to create a strong draught for two boilers 30 inches diameter and 30 feet long? A. Direct a thin flat jet of steam up the smoke stack.

(31) E. A. D. P. asks: Will well glazed earthen jars do for a battery for a short telegraph line, say ½ mile, as well as glass? A. Yes.

(32) C. L. writes: 1. In your issue of 28th ult., you describe a simple electric light. Should the carbon holders be made of brass? A. Yes. 2. Could the upright be made of varnished wood? A. Yes. 3. What is a Bunsen cell? A. See reply (24), p. 139, current volume of SCIENTIFIC AMERICAN. 4. Would the light produced by this apparatus be sufficient to light a room 20 x 20? Would several common copper and zinc batteries suffice? A. See reply to H. E. M., on next page.