A NEW FOOT LATHE.

It is an important matter for an amateur or mechanic doing work with small tools to procure such implements as will be a source of profit, pleasure and satisfaction, instead of lasting regret that tools of another make were not purchased. Among such tools a lathe is an important item, and once purchased is not likely to be soon exchanged. A lathe which appears to fulfill all reasonable requirements is shown in the accompanying engravings. The chief novelty of this

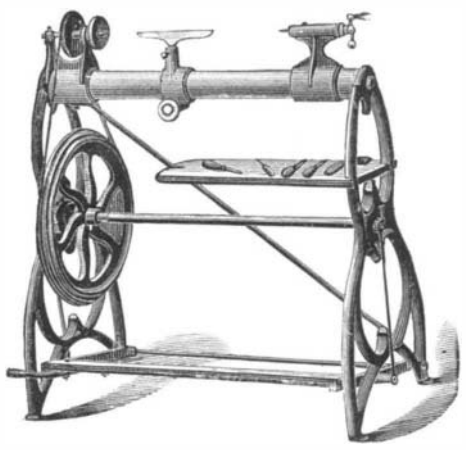


Fig. 1.—MARSH'S CYLINDER BED FOOT LATHE.

lathe is its cylindrical bed, which possesses many advantages which will be apparent to our readers. The bed is 36 inches long, and the head, tail, and tool stocks are bored to fit it.

The head stock is fastened permanently with a set screw. The tail stock traverses the whole length of the bed, and is kept in line with front center by a groove in the bed, and is readily fastened at any point by turning a hand screw, which is on the back side of lathe and not shown in cut. The tool stock also encircles the bed, moves back and forth readily, and rocks to and from the work. It is sawed open on the bottom, and provided with a screw, which is sufficient to hold it at any point by a single turn of the hand. It has a steel mandrel, two steel centers, two T rests, and a tool shelf.

It has a brass box in front journal, and true bored iron bearings throughout. It has a three cone grooved pulley, turned up true, and polished. The balance wheel is turned and grooved to correspond with cone pulley, and is weighted to counterbalance the treadle. The crank shaft runs the whole length of lathe, resting in Babbitted journals, and has a crank on each end, thus avoiding any unequal strain upon the frame, and securing steadiness. It runs lightly and freely, with high speed.

This lathe has three useful attachments: a circular saw attachment, a bracket moulding device, and a scroll saw. The circular saw attachment, shown in Fig. 2, is easily applied, and the table, which is a light iron one, dressed up true, is supported by a standard set in the tool stock, and admits of being rocked and tipped so as to saw any bevel desired. It has two light running metal gauges for slitting and cutting off.

The scroll saw attachment (Fig. 3) is very simple, and useful for sawing all kinds of scroll and fret work. It is readily attached or detached without pulling the lathe in pieces. The driving attachment of the saw has a perpendicular stroke, which is important in the perfect working scroll saw. The spring and tension are firmly attached to the tail stock without the removal of a bolt or screw. The table tilts 45° without losing its central position, and the swing around under the arm is 25 inches.

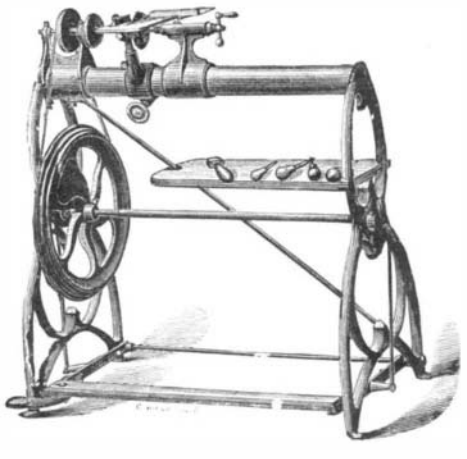


Fig. 2.—LATHE WITH CIRCULAR SAW ATTACHMENT.

The attachment shown in Fig. 4, for moulding and ornamental brackets and other scroll work, adds, with very little expense, a very desirable feature to the foot lathe. The standard of the table is threaded, and is adjusted up and down by turning it around. The capacity of the cutter is such as to follow the scroll saw into very delicate points, and open and mould them so as to give the work a more open and light as well as a more ornamental appearance. The cutters have double cutting edges, and cut as well when revolving one way as the other.

This lathe is manufactured under the recent patent of E. A. Marsh, by the Battle Creek Machinery Company, Battle Creek, Mich., from whom further information may be obtained.

Recent Engineering Inventions.

Mr. Erastus B. Kunkle, of Fort Wayne, Ind., has patented an improved Gauge Cock for Steam Boilers, which consists of a tube having its upper end closed by a nut, through which the valve stem passes, and provided with a vacuum chamber between the nut and the discharge pipe, for preventing the steam or water from passing through the threads of the nut and scalding the operator. It has a valve seat at its inner lower end, as near as possible to the boiler, leaving no space for sediment or scale to collect and clog the valve.

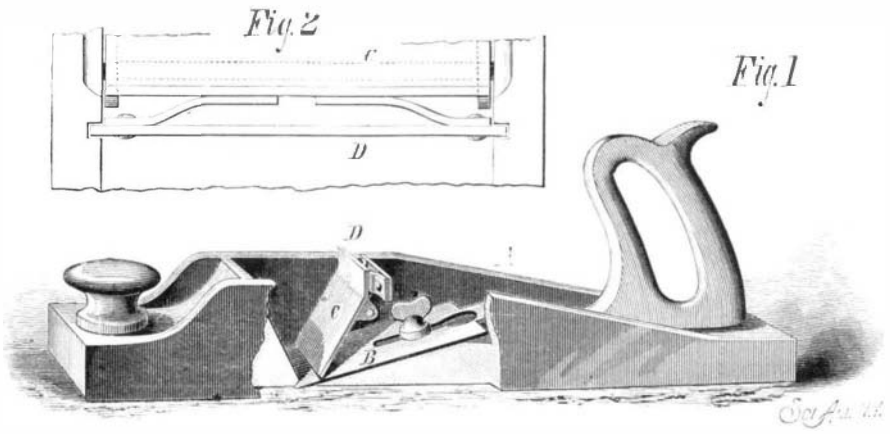
An improvement in Drilling Machines for Artesian and other Wells has been patented by Mr. Jesse Button, of New York city. The object of this invention is to construct the framework and machinery used in boring artesian and other wells in a compact and convenient form, for saving labor and space, and to enable the machine to be conveniently moved from place to place.

A NEW BENCH PLANE.

The accompanying engraving represents an improved bench plane, recently patented by Mr. Patrick Gallagher, of Eureka, Nevada. In Fig. 1 the side of the plane is broken away to show the internal construction, and Fig. 2 is a detail view of the cap supporting device.

The improvement is applicable to either a jack plane, fore plane, or jointer, of wood or iron.

The iron or bit, B, is screwed by a clamp screw in the body of the plane, A, forming a small angle with the bottom of the plane, and it is held in position near its cutting edge by the cap, C, which is pivoted on a pin that runs transversely through the plane. The position of the cap above its pivot is pressed forward by two strong springs that are



GALLAGHER'S PLANE.

supported by a cross bar, D, fitted to slots in the sides of the plane. These springs keep the cover down on the lower end of the bit or iron, holding it firmly in place. As the cutting iron lies more nearly flat than in ordinary planes it will make a smoother surface, and it is more easily adjusted than irons fastened with a wedge in the usual way.

New Inventions.

Mr. Jonathan Miller, of Trenton, N. J., has patented an improved combined Urn and Water Bottom. This is a stoneware receptacle for beverages, provided with a water bottom having communication with two tubes formed upon the outside of said urn, into one homogeneous piece therewith.

Mr. Eliot S. Hunt, of Elizabeth, N. J., has patented an improved Gate Hinge, constructed so that the gate when closed may be in line with the fence, and will allow the gate to be swung back against the fence without straining the hinges.

Mr. Francis Keil, of New York city, has devised an improvement in that class of Cylinder Latch Locks which cannot be opened from the outside of the door without its own especial key. It is simple in construction and not liable to get out of order.

Mr. John S. Birch, of Orange, N. J., has patented an improved Gun Wiper, having a novel device for connecting the wiping head to the rod, whereby the variations in the sizes of the screw shanks of different heads will not interfere with connecting different heads with the same rod.

An improved Device for Forcing Air into and through the Water contained in Wells, cisterns, tanks, and other vessels to purify it, has been patented by Messrs. Jerome S. Higgins and Riverious T. Higgins, of California, Mo.

Mr. John H. White, of Huntsville, Ala., has patented an improved Match Splint, which is triangular in form. The advantages claimed are a saving in material, producing with a minimum expenditure of material a strong splint. The sharp angles of the splint afford a ready and effective medium for rapidly communicating the flame from the head to the body of the splint, and, as a larger number of splints can be cut from a given quantity of wood, it follows that for purposes of transportation a given number of splints can be packed in a smaller space.

An improvement in Adjustable Sieves has been patented by Mr. John Dildine, of Milton, Pa. The object of this invention is to furnish an improved sieve for sifting flour,

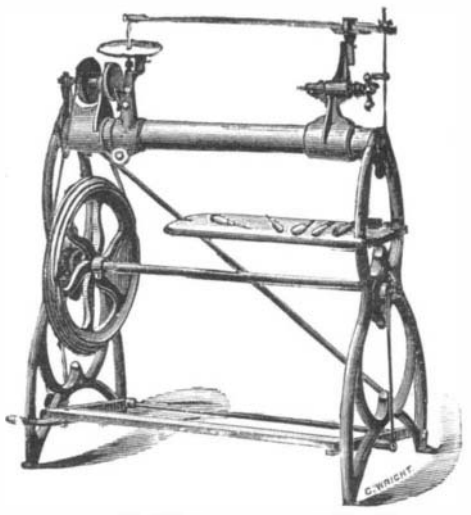


Fig. 3.—SCROLL SAW ATTACHMENT.

meal, seeds, and other things requiring to be sifted or separated. It is so constructed that it may be readily adjusted to make the meshes smaller or larger, as may be required.

Mr. Henry Hardick, of Liberty, N. Y., has patented an improved Fence. This invention consists in a metallic post having an anchoring cross bar or foot cast upon its lower end, and buttons upon one of its vertical sides, for the attachment of the wire rails; an intermediate stay post is also provided, which anchors a vertical cross tie connecting the longitudinal wire rails.

Mr. Louis R. Sassinot, of New Orleans, La., has invented an improved Portable Furnace. This invention is designed for portable clay furnaces to provide a basket frame that will at the same time serve as a permanent support.

Mr. Simon H. Wiesedeppe, of Seneca, Kan., has patented an improved Animal Trap, which is simple in construction, inexpensive, and reliable, catching the animal and holding him securely without hurting him, and without alarming other animals that may be near.

Mr. Heinrich Baum, of Höchst-on-the-Main, Germany, has patented an improvement in Coloring Matters to be used as Dyes. This invention consists in manufacturing red, yellow, and brown colors from the two disulphobetanaphtholic acids by means of diazo compounds of xyloidine.

Mr. Benjamin Landon, of Canton, Pa., has devised an improved Mouth Piece for Mail Bags, that can be easily and quickly opened and closed, and that will remain open when matter is being taken from the bag without being held, but at the same time can be securely closed and locked.

A Hose Cart, which may be used to transport hose from place to place, and in which the motion of the cart is made available for winding or unwinding the hose rapidly without straining it, has been patented by Mr. John Wilz, of Santa Cruz, Cal.

Mr. Andrew Sheridan Burt, of Omaha, Neb., has patented an improved Tent, having a double row of eyelets or grommets along the edges of the sections of canvas which form

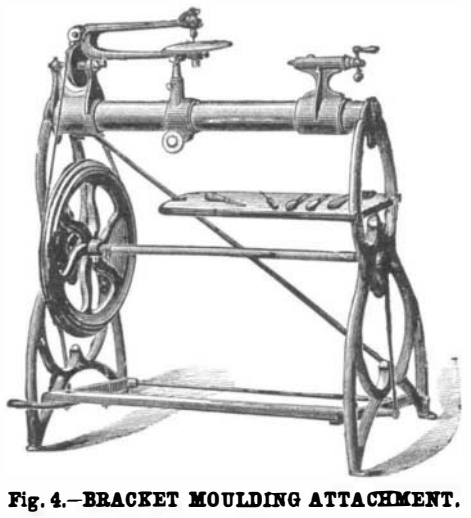


Fig. 4.—BRACKET MOULDING ATTACHMENT.

the ridge, and having flexible knotted chain loops adapted to be laced diagonally.

Mr. Paren England, of Lincoln, Neb., has devised a combined Sash Lock and Weather Strip, designed to both lock the sash in any position, and at the same time to tightly close the joint between the sash and the framing, to prevent the entrance of cold air, dust, or snow,

Theory and Practice.

At a recent meeting of the California Academy of Sciences, Professor Joseph Le Conte remarked as follows:

There is a common, deeply rooted prejudice in the popular mind—and it seems to be affecting even scientific men, on the one side, as well as practical men on the other—that there is a kind of antagonism between theory and practice.

Now, so far from this being the case, a true theory is indissolubly connected with a true practice. There is an indissoluble marriage bond between them. It is even closer than this: it has the relation of spirit and body. Science is a complex web, woven warp and woof; the warp is scientific theory, the woof is the material derived from nature. It is impossible that one should exist apart from the other. Every intelligent human action, particularly of the complex kind, is necessarily guided by theory. And this is the true difference, in fact, between human activity and ordinary animal action. Human action is the most complex, and it is always guided by theory. The only difference between good practice and bad practice is that one is guided by good theory, and the other is guided by false or bad theory. But all human action which pretends to be intelligent or rational, is guided by some theory, good or bad.

There is, I admit, a kind of theorizing, a spirit of theorizing, and a theoretical habit of mind, which is destructive of good practical work. But it is equally destructive of true science also. I refer to that theorizing upon an unsubstantial basis, that theorizing merely for the sake of theorizing, and merely for the pleasure of the intellectual activity of theorizing—merely for the self-complacent contemplation of the beauty of the theories that we create out of our minds. In this case the whole web, woof and warp, is woven out of the human mind, without the material being furnished to it by nature. It is like castle building in the air, unsubstantial and resting upon a cloud; beautiful it may be to contemplate, but rapidly disappearing before the sun. It is like spiders' webs, woven out of its own bowels, both warp and woof; beautiful and intricate in its structure, and glittering with the dew in the early morning, but quickly brushed away from the path of progress. This kind of theorizing is equally as fatal to true science as it is to practical work.

This kind of theorizing is what we would call speculation. Now speculation bears the same relation to true theorizing in the world of science, which speculation bears to legitimate enterprise in business. As speculation in the field of business is prostrating to true enterprise, and through it prostrating to the true prosperity of the community, even so speculation in the realm of science is destructive to true theorizing, and therefore destructive to real practical work.

But as enterprise is the basis upon which all legitimate industry rests, and must inevitably rest, and the whole prosperity of society must also rest with it, even so it is upon sound, cautious, inductive theorizing that the whole progress of science and also of sound practical work is based. Science is the open foe of speculation in both fields. Science is the fast friend of legitimate enterprise and legitimate industry, also, in both fields.

The Evaporation of Moisture from Leaves.

An exhaustive study on the physical functions of leaves has recently been published by Professor J. Boussingault, of Paris, in which the phenomena connected with the absorption and transpiration of leaves are treated at great length.

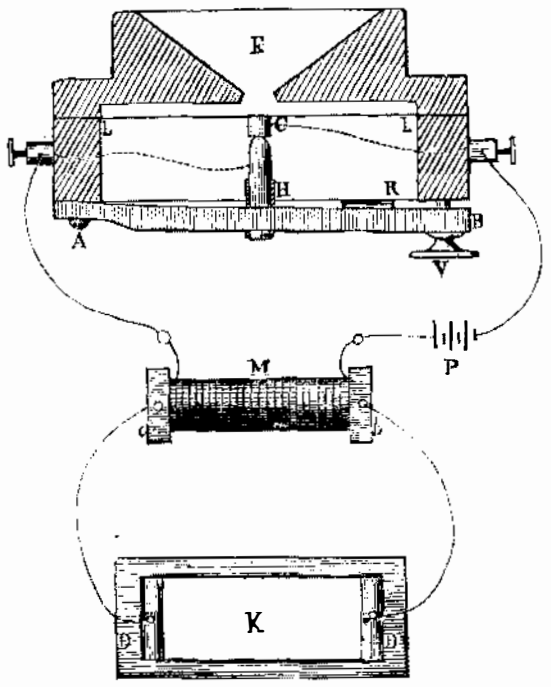
Among others, numerous experiments were made on the difference in evaporation during the day and night. Those carried out with the leaves of the grape vine gave the following hourly averages per square meter of foliage: in sunshine, 35 grammes (560 grains); in shade, 11 grammes (176 grains; during the night, 0·5 gramme (8 grains). The trellis on which the vine was trained was 39 inches high and 125 feet long, and presented a surface of 406 square feet of foliage. In sunny weather this was found to lose by evaporation in the course of 24 hours, 120 lbs. of water, and nearly half of that amount during cloudy weather. To give an idea of the enormous amount of aqueous vapor dissipated by plants in the sunshine, calculation showed that an acre of beets could lose in the course of 24 hours between 20,000 and 23,000 lbs. Another experiment made with a chestnut tree 35 years old showed that it lost over 16 gallons of water in the course of 24 hours. The structure of the leaf, however, containing 70 to 80 per cent of water, and possessing a thickness frequently of not more than four-thousandths of an inch, the question might occur why the evaporation is not much more rapid. The answer to this is found in the peculiar structure of the tissue forming the epidermis, designed especially to moderate the transpiration. In order to observe the remarkable retentive power exercised by this epidermis, one may expose for a few hours to the sun two cactus leaves of the same superficies, one of which has been deprived of its epidermis. In the case of the latter the evaporation will be about fifteen times as rapid as in the other. It is the presence of a similar tissue, forming the skins of fruits, which prevents an evaporation that would be otherwise too rapid. An apple, for instance, deprived of its skin, loses 55 times as much water as a whole specimen in the same time. The physiological energy of leaves is notably lessened by losses resulting from rapid evaporation. Thus an oleander leaf, containing 60 per cent of water, when introduced into an atmosphere containing carbonic acid, decomposed 16 cubic centimeters of this gas; one containing 36 per cent decomposed 11 cubic centimeters, and one containing but 29 per cent was without action.

IMPROVED MUSICAL CONDENSER.

Some time ago Mr. Varley constructed an apparatus, called by him the "musical or singing condenser," and the same is now being exhibited in London and attracting general attention. The apparatus, like so many others of similar character, is too complicated and incomplete for practical purposes. It consists of the receiver, the transmitting apparatus, and the condenser. The latter, K, is composed of a pile of leaves of paper and tinfoil, following alternately; the pairs 2, 4, 6, etc., are united together at one end; the pairs 1, 3, 5, etc., at the opposite end. The whole is inclosed by copper frames, D D', supplied with screws to connect the wires. The sheets may be firmly compressed, the operation not being disturbed thereby in the least.

The receiving and transmitting apparatus consists of a sort of telephone, E. The place of the diaphragm is filled by a sheet of metal foil, L L, in the center of which is fastened a cylindrical piece of carbon, G. Against the latter is placed a second carbon cylinder, H, resting on a wooden crosspiece, A B, fastened at A to one wall of the case, B, by means of a regulating screw, V, to the other wall. A spring, R, extending across the board, A B, imparts to the latter a certain degree of elasticity, which is necessary to insure success.

The metal sheet receiving the sound is connected with one of the poles of a battery, consisting of six Leclanché cells; the lower carbon cylinder is connected with the primary helix of the induction coil, M, which connects on its part with the other pole of the battery. Finally the two poles of the secondary helix of the coil are connected with the ends, D D', of the condenser.



VARLEY'S MUSICAL CONDENSER.

The secondary helix of the coil consists of twenty layers of No. 32 wire, well covered with silk; the primary helix consists of five layers of No. 16 wire. The length of the coil does not exceed 2¾ inches, and the core is ⅜ inch thick.

The receiving and transmitting apparatus must be regulated by experimenting. The two carbon points, when at rest, should not touch each other, but must be brought into contact by the slightest vibration of the metal sheet. The right position may be determined as follows: When the same note is repeatedly sounded into the collector, the carbons may be approached till the sound is distinctly reproduced. When three notes, sounded in succession into the collector, are plainly heard from the condenser, the apparatus may be considered sufficiently well regulated. The melody must be sung into the receiver while the mouth is placed as near as possible to the entrance. Voices resembling the sound of a flute are most easily reproduced.

The apparatus may be used in the same way as Edison's telephone. When it is used as a microphonic receiver, the carbon points must be brought into contact.—*L'Électricité.*

Natural History Notes.

An Aquatic Fern.—Professor D. C. Eaton, in a communication to the *Bulletin of the Torrey Botanical Club*, announces four additions to the fern flora of North America. These are all tropical species, and were detected in Florida. One of them, *Ceratopteris thalictroides*, is one of the most peculiar of ferns, and was discovered growing in the waters of Prairie Creek. It is as truly an aquatic plant as pickerel weed (*Pontederia*), or burr reed (*Sparganium*), and has been found in still or slowly moving waters in most tropical and many sub-tropical regions. It occurs in several of the West Indies, in Mexico, New Granada, and Brazil, and in Africa, Madagascar, India, Java, Hong Kong, Australia, etc. The sterile frond varies from a perfectly simple leaf to one which is twice or three times pinnate; the simpler ones are floating, and are produced early in the season, and the more compound fronds come later, and are emergent. The veins are everywhere finely reticulated. The fertile fronds have very numerous linear, or somewhat podlike segments, with the margin reflexed to form a broad and continuous membranaceous involucre. The sporangia are scattered on the backs of the veins, and are nearly globose in form, and are more variable in respect to the ring than in any other fern. This organ is sometimes entirely wanting; at other times it is composed of a few obscure joints; and again it is broad and nearly complete. So variable is this fern that at least four genera and two suborders have been found for its reception; and, though Hooker placed it at the end of the *Pterideæ*, its proper position among ferns is by no means yet settled. Up to the present but two sterile specimens of this curious plant have been found, but it is hoped that ere long the discoverer, Dr. Gurber, may be successful in his search for fruiting fronds.

Embryology of the Gar Pike.—The gar pike (*Lepidosteus*) being one of the few living survivors of those vast extinct orders of geologic ages, it has been considered especially important by naturalists that means should be taken to compare its embryology with that of other modern fishes in order that the structure of past races might be more fully known, and more light thrown on modern questions of evolution. As much as this knowledge has been needed, no one had been successful in raising the young of the gar pike till last summer, when Mr. Alexander Agassiz accomplished it. The results of his observations are recorded in a paper read before the National Academy, in this city, during November. The gar pike ascends the St. Lawrence in May, and about the 20th lays its large viscous eggs, which stick fast in an isolated way to whatever they happen to alight on. The eggs look very much like those of toads, having a large outer membrane and a small yolk. Mr. Agassiz's assistant brought to Cambridge about 500 naturally laid eggs, all but thirty of which were destroyed by mould. The young began to hatch in six days, and Mr. Agassiz began his studies, the misfortune to the eggs preventing any examination previous to the birth of the fish. He found that the little gar pikes were not so different from the young of the bony fishes as he expected. He did not make out the development of the lung; but, judging from external characters, the difference is small. Connection with the sharks was exhibited in the similarity of the branchial arches, and by the presence of the lateral fold in which the pectoral fins are formed. The manner in which the tail is developed was found to be very like what takes place in the bony fishes. Among the ganoids the dorsal cord is at first straight, then it assumes a slight curve upward at the extremity, and finally there appears, underneath, the beginning of a lobe pointing toward the complete heterocercal tail. This is likewise so in the bony fishes; but in the gar pike it is a permanent condition, while in the bony fishes the extremity of the dorsal cord becomes extinct. The mode of development of the pectoral lobe furnishes another point of resemblance. A likeness to the shark is noticeable in the brain and mode of formation of the gills. The young gar pikes are slow in their movements, swimming about but little, and attaching themselves to fixed objects by an extraordinary horseshoe-shaped ring of sucker appendages about the mouth. The summing up of Mr. Agassiz's investigations is, that the young gar pike has many characteristics in common with the sharks and skates, but is not so different from the bony fishes as has hitherto been supposed.

The Sequoias.—Mr. John Muir has an interesting paper in *Harper's* upon the "New Sequoia Forests of California." He gives therein the details of a discovery by himself of a grand forest of *Sequoias* seventy miles long, lying considerably south of the isolated groups hitherto known, and containing large numbers of saplings, which indicate that the species is still in a vigorous state of existence. It has heretofore been argued that the few groups of these trees known made it probable that the species was dying out from its last strongholds upon the earth, for it has come down to us from pre-glacial times, when it existed in Europe also, as geology testifies. Mr. Muir's researches lead him to believe that the species has never been more extensively distributed on the Sierra in post-glacial times than it is now; and that to-day it is as full of life and vigor as it was 10,000 years ago.

Instinct in a Crab.—Dr. Darwin, in his "Voyage of a Naturalist," thus describes a crab which makes its diet of cocoanuts, and which he found on Kneeling Island, in the South seas:

"It is common on all parts of this dry land, and grows to a monstrous size. It has a front pair of legs, terminated by a strong and heavy pincers, and the last pair by others which are narrow and weak. It would at first be thought quite impossible for a crab to open a strong cocoanut covered with the husk; but Mr. Liesk assures me he has repeatedly seen the operation effected. The crab begins by tearing the husk, fiber by fiber, and always from that end under which the three eyeholes are situated. When this is completed the crab commences hammering with its heavy claws on one of these eyeholes till an opening is made; then turning around its body, by the aid of its narrow pair of pincers it extracts the albuminous substance. I think this is as curious a case of instinct as I ever heard of, and likewise of adaptation in structure between two objects apparently so remote from each other in the scheme of nature as a crab and a cocoanut."

A Viviparous Cockroach.—At a recent meeting of the Entomological Society of London, Mr. Wood-Mason stated that it might interest the members of the Society to hear that in the course of his anatomical work he had discovered a remarkable case of viviparity in the orthoptera, in a large cockroach belonging to the genus *Panesthia*, the species of which inhabit the tropical forests of Southern Asia and of Australia, where they live in the rotten wood of fallen