DEEP SEA FISHES.

The marine explorations that have been made during the last few years by American, English, and French expeditions have shown that the deep sea fauna is wonderfully rich in strange forms of fishes, and it is now known that no less than twenty-eight families of these animals are confined entirely to great depths, or are represented elsewhere by mere stragglers. Three new family types were obtained last year. As regards orders, two, the Lyomeri and the Cavencheli, are only known from deep sea representatives.

The fact that fishes which live permanently at great depths exhibit certain peculiarities of form should not surprise us, when we consider that the structure of these animals has to suffer important modifications before being adapted to these peculiar conditions of life. Various influences act upon these fishes. Light and vegetation are wanting, and, beyond a certain depth, the temperature tends to become equalized, and the water is always calm. The modifications due to such conditions relate to the structure of the tissues, the size of the eyes, the development of the sense of touch, and to coloration. Moreover, these fish have organs that are not possessed by ordinary animals of their class, and the function of which is to emit a phosphorescent light, and to thus make up for the light of day, which does not reach them.

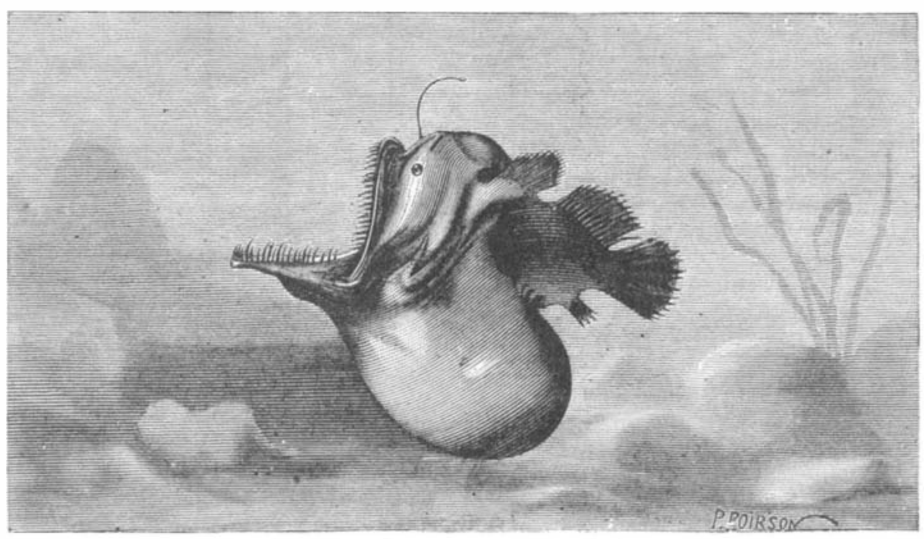


Fig. 1.—MELANOCETUS JOHNSONI.

The changes that the tissues have undergone are seen in the structure of the skin, muscles, and bones. The skin is thin and lacking in bright colors, the shades varying from grayish to a velvety black. The scales, which are often much reduced in size, are so slightly attached that even the friction that they experience during the ascent of the trawl serves to remove almost all of them. The muscles are flabby, and, having no flavor, are not edible.

Contrary to what we should expect, the eyes of fishes living continuously at great depths are of normal size, and are peculiar in neither position nor structure. This is not the case with those species that live at depths to which a little light penetrates, for in these the eyes are quite large in order to present a larger sensitive surface. The phenomenon is explained when we consider that, as above stated, these deep sea species have the faculty of emitting a phosphorescence that lights up a considerable space about them and serves to guide them.

Fishes living at great depths seem to move but little, and evidently lie buried in the mud. It often happens that several fin rays, instead of performing the ordinary functions of such appendages, become converted into organs of touch. One of the most remarkable examples of this is shown by a fish captured at a depth of 13,120 feet, in the Talisman expedition off the coast of Africa, the *Melanocetus Johnsoni* (Fig. 1). In this fish, which was till then known only from a single specimen that was found floating on the surface near Madeira, the first ray of the dorsal fin is developed and forms a genuine organ of touch, answering the same purpose as the one possessed by the goose fish. In this latter also there is a tentacle at the extremity of the first ray of the dorsal fin. The goose fish lives in the sand or mud, where by means of its fins it makes a cavity in which it buries itself so as to allow only the upper part of its body to project. The tentacle, which is ever in motion, serves as a bait to attract prey. The Talisman's collection embraced other various fishes that exhibited similar transformations of the fin rays into tactile organs.

All fishes that live continuously at a depth greater than 2,000 feet are carnivorous. This results from the fact that, owing to the absence of light, vegetation gradually disappears as we descend, and, consequently, all species of fish that do not ascend to within five hundred feet of the surface (the point at which the last algæ are found) are obliged to hunt for animal food. Fig. 2 shows one of these species, *Macrurus australis*, which was taken by the Talisman expedition at a depth of 14,740 feet. One of the most remarkable features of fishes living at these great depths is the great development of the mouth and the stomach, as may be seen in the species that we represent in Fig. 1, and of which we have already spoken. In this fish, *Melanocetus*, the capacity of the stomach is such that it is capable of holding prey whose size is double that of the fish's own body.

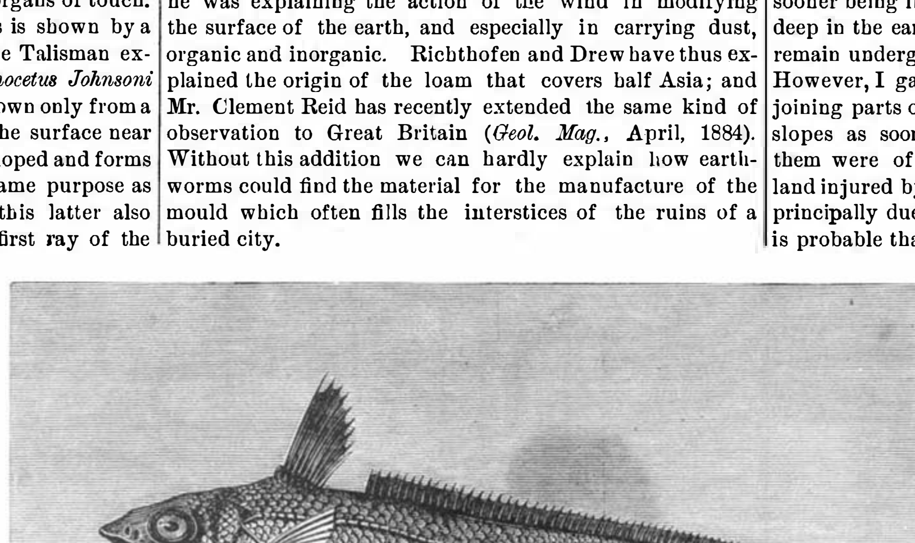


Fig. 2.—MACRURUS AUSTRALIS.

One of the most interesting questions concerning the distribution of fish relates to the maximum depth at which these animals are met with. During the cruise of the Talisman the fish caught at the greatest depth was the one above noted—*Macrurus australis* (14,740 feet). The Challenger expedition took a fish (*Bathyophis ferox*) at a depth of 16,460 feet.

CAPT. ELIJAH RAYNOR, of the Ranger, of Greenport, caught off Fire Island lately 1,200,000 menhaden.

Notes on Earthworms.*

Ever since our great naturalist called attention to the common earthworm, we watch them with entirely different eyes as they creep timidly out on to the lawn or hurry across the gravel walk; as they collect the dead leaves or bits of string and cloth we may have dropped the evening before, or heap up their household refuse outside the entrance to their home.

He long ago pointed out its importance as a geological agent. The surface of the ground would be very different were it not that the earthworm is for ever at work bringing in the decaying vegetation and converting it into mould. And, more than this, the superficial deposits are often modified to a considerable depth by the earthworms, which, carrying the earth mouthful by mouthful, and the gravel stone by stone, invert the order of stratification.

But we must not push this explanation of the origin of the universal surface mould too far. I received one caution from Darwin himself many years ago when I was talking to him about the manner in which the chalk with which the land was dressed in Kent worked down. He told me to be careful to bear in mind the action of the great Kentish plow as it year by year turned swath after swath down the slopes. The result of this plow down is clearly distinguishable from worm mould. In his work on earthworms also he refers to another mould forming agent of more universal operation and hardly less important cumulative effect. My attention was first directed to it by a lecture I heard delivered by Stoppani in Milan many years ago, in which he was explaining the action of the wind in modifying the surface of the earth, and especially in carrying dust, organic and inorganic. Richthofen and Drew have thus explained the origin of the loam that covers half Asia; and Mr. Clement Reid has recently extended the same kind of observation to Great Britain (*Geol. Mag.*, April, 1884). Without this addition we can hardly explain how earthworms could find the material for the manufacture of the mould which often fills the interstices of the ruins of a buried city.

We find, commonly, isolated tumps of moss covered soil, and every gradation from that up to the large patches of mould which hang like little gardens on each sheltered ledge, where the greater part of the material must evidently have been carried from elsewhere and not have been brought up from below; where it is obvious, from the character of the rocks, that the principal part of the mould cannot have been derived so much from them as from the wind carried fragments of organic and inorganic material and the decomposition of the vegetation that soon began to grow upon it.

But we find also that the earthworms soon appear in such places, and set to work to mix up and modify all this various stuff that has by various agencies been brought together.

As squirrels, burying acorns and nuts in the autumn, have planted many an oak forest and hazel grove, so it is probable that the earthworms plant many of the ash and sycamore trees that we see perched in out-of-the-way corners, where it is difficult to explain how the blown seed can have got covered by mould enough to allow it to germinate. If an overhanging tree drops the seed, or the wind carries it anywhere near the worm's feeding ground, it is dragged in and planted in leaf mould, and kept moist till spring time. At this time of the year we see clusters of sycamore seedlings growing up together out of the little worm hills into which they had been dragged heavy end first.

It is therefore interesting to inquire into the various reasons that should make earthworms travel and occupy new ground. Round the margin of an overcrowded colony we should expect them to spread. They cannot live under water, so they have to move away before a flood. It has been stated that "they may live when completely submerged in water for nearly four months" (Romanes reviewing Darwin, *Nature*, vol xxiv., p. 553). But they were killed off by a flood of a couple of days' duration in the backs of the Colleges of Cambridge in August, 1879. Some of them seem to have got on to the paths, which are raised above the surrounding meadows, and there died. Where the greatest number were found dead the ground had been submerged for a longer time. The following carefully recorded observations by the Rev. Henry Russell, of St. John's College, are worth noting:

"On Sunday, August 3, 1879, our paddock (the inclosed space in which the men play at lawn tennis, in front of the new court), was covered with water to the depth, at 1 P.M., when it was greatest, of four to five feet. The level of the paddock is much lower than that of the ground surrounding it. . . . Therefore, on Wednesday, August 6, I cut a trench from the northwest angle of the paddock across the raised path. . . . The water had drained off by Saturday evening, August 9. The rush of water from the west across the Fellows' garden had carried with it into the paddock a great quantity of worms, which, when the water had subsided, were observed, some very large, lying dead under the water. As the water drained off, these lay on the paddock and on the slopes of grass surrounding it, and the smell of them infected the air till Friday, August 15."

Mr. Russell's observations go to show that the worms found dead were not all worms that had lived in the paddock, but those which had got washed out with the earth from the Fellows' gardens, and so they perhaps perished sooner being in the water. It is probable that worms buried deep in the earth under submerged meadows may, if they remain underground, hold out through much longer floods. However, I gather that a large number perished in the adjoining parts of the backs, and were seen on the paths and slopes as soon as the flood began to subside. Many of them were of exceptionally large size. I have heard of land injured by floods where the injury was supposed to be principally due to the destruction of all the earthworms. It is probable that the growth of peat mosses may be in great part referred to the fact that the conditions were unfavorable to earthworms, for had they been there they would have worked up the vegetable matter into mould.

But there must be something besides floods that makes earthworms migrate.

If we drive a stick into the earth and move it about so as to shake the ground, the earthworms will come out to the surface and scuttle away in all directions. This was a common way of getting worms for fishing, and we used to be told, as Darwin notices, that the worms came out because they thought a mole was digging after them.

There must be, however, some other reason why worms will often come out to the surface in the daytime, and hurry away across a gravel path or on to a road, and why they then seem so much less sensitive to tremor of the ground about them than do the worms that come out to feed on the lawn.

From the analogy of other more highly organized animals I could not help thinking that there must be some creature that hunted the common earthworm, some worm ferret that drove them out. Many who have passed their lives in the country know well when they see a large field mouse cantering down a road and showing little fear of man that a fiercer enemy than man is following the poor little animal with untiring certainty. If you draw aside and watch, you will soon see a weazel following by scent. Even a hare or rabbit will at length lie down paralyzed with terror, and give itself up to the stoat that has followed it with deadly pertinacity. The sudden appearance of one or two strange birds in a neighborhood has often been a source of wonderment, and it has sometimes been suggested in explanation that they had been chased by birds of prey and got up into strong currents of air. Those who have seen a peregrine drive a

* T. McKenny Hughes, in *Nature*.

flight of rooks up into the sky can easily see how this might happen. In the cases to which I am referring, the earthworm comes out like a hunted thing. I have also noticed that many of the worms that I found dead or torpid were maimed; generally they had their tail cut off, and this when there had been no digging in my garden for a long time, and although there are few birds that would touch them. I have frequently observed that the earthworms were apparently unwilling to go to ground again, though I have tried to make them, in order to watch the rate and manner in which they bury themselves.

A few days ago, however, I saw, I believe, the explanation of most of the cases I had been observing. A large earthworm about nine inches long, bright, clean, and healthy looking, was moving somewhat irregularly on the earth of a flower bed. On stooping to examine it, I found a small yellow animal with a brown head holding on within about half an inch of the tail end of the worm. I sent it to Prof. Westwood, who writes: "Your worm eating larva is evidently one of the Carabidæ, probably *Steropus madidus*" (see *Gardeners' Chronicle*, 1854, p. 613). It was not disturbed by my taking up the worm, but went on biting its way round the worm, holding on like a bull dog, and bettering its hold every now and then. It had nearly got round the worm, leaving a lacerated ring. The wounded part seemed somewhat swollen, but on this point I am not clear, as the unequal power of extension of the wounded part may have produced the effect of swelling.

Mr. Edwin Laurence has recorded (*Nature*, vol. xxvi., p. 549) a similar circumstance observed by him in France, where, however, the larva seems to have attacked the worm differently, and with a view to killing it rather than cutting off a portion, and from his description, moreover, it would not appear to be the larva of the same species. He suggests that the numerous birds in England may have destroyed such an enemy of the earthworm. A sparrow would probably take the larva, and not touch the earthworm. One would have thought that the earthworm would have a better chance of rubbing off his deadly enemy in the earth than above ground, as a salmon is said to clean himself in a gravelly river, but we want further observations on this curious question, as well as on several others raised by the inquiry, How are worms transported to out-of-the-way places? and, How long can they live in soils of various degrees of permeability when the surface is flooded?

Consumption of Railway Ties.

There are now fully 148,000 miles of railroad *track* in the United States, and therefore about 391,000,000 ties, and the average consumption for renewals should be about 56,000,000, or the product of 560,000 acres of land, at 100 ties per acre, requiring 126,800,000 acres = 26,000 square miles, equal to less than half the area of Michigan or Wisconsin, two-thirds the area of Maine, and a little more than half the area of North Carolina, if, as reported, it takes 30 years to grow tie timber.

Mr. Hicks says that the reports to the Forestry Department show that it takes an average of 30 years to grow timber large enough for ties, and that the product is about 100 ties per acre, while the average cost of ties to the railroads is 35 cents. This is a product worth $35, as the return of an acre for 30 years. If this is all, then with money at 5 per cent, no cost of cultivation and no taxes, it will pay to grow ties on land already wooded worth $8 per acre, and on land worth $7 per acre if interest is 6 per cent.

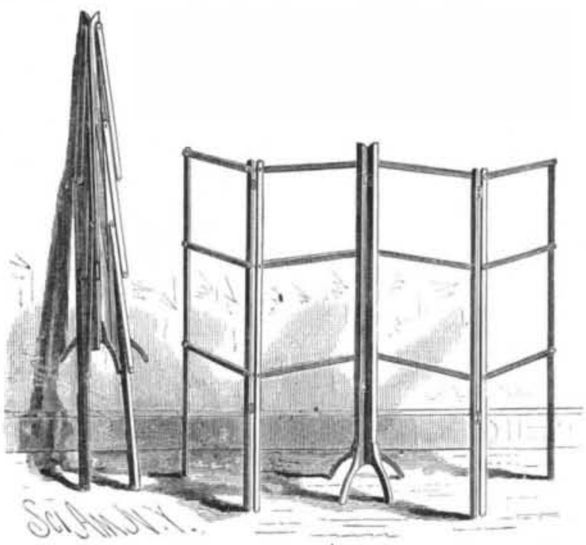
If 113·3 acres of woodland are required to maintain the ties of every mile of railroad, the question with the railroads, says the *Railroad Gazette*, is not simply whether they should produce their own ties, but also whether they may not profitably diminish their consumption. The experience of Germany indicates that an average life nearly three times as long can be had by preserving the ties with chloride of zinc, or creosoting (so called, for there is usually little or no creosote in the oil used). But even if the product of 56 acres per mile is required, it does not follow that the only escape from a famine will be the cultivation of timber. If land planted or stocked naturally with the trees which will make 100 ties in 30 years is worth $20 an acre—and in many parts of the country it is worth as much as that—at the end of the 30 years required to grow the trees it will represent, with interest at 6 per cent, $118, and with interest at 5 per cent, $88; and if then the land after the ties are cut is still worth $20 an acre, the 100 ties, before cutting, will have cost $98 in the one case and $68 in the other. But the taxes meanwhile would probably have cost $50 or $60 more, and there would be some expenditure for care. If then the land is not cheaper than $20 per acre, the railroad will probably do better to depend upon some metallic substitute than to grow tie timber, even if it gets 14 years' life out of a tie.

Better to Wear Out than Rust.

The late Prof. Samuel D. Gross at a dinner given to him in Philadelphia on April 10, 1879, said: "After fifty years of earnest work I find myself still in the harness; but although I have reached that age when most men, tired of the cares of life, seek repose in retirement and abandon themselves to the study of religion, the claims of friendship, or the contemplation of philosophy, my conviction has always been that it is far better for a man to wear out than to rust out. Brain work, study, and persistent application have been a great comfort to me, as well as a great help; they have enhanced the enjoyment of daily life, and added largely to the pleasures of the lecture room and of authorship; indeed, they will always, I am sure, if wisely regulated, be conducive both to health and longevity. A man who abandons himself to a life of inactivity, after having always been accustomed to work, is practically dead."

CLOTHES HORSE.

The engraving shows an improved clothes horse, for which letters patent have been applied for by Mr. M. F. Blake, of Martinsburg, Pa. Each frame consists of two side bars, to each of which are loosely riveted the ends of cross bars,



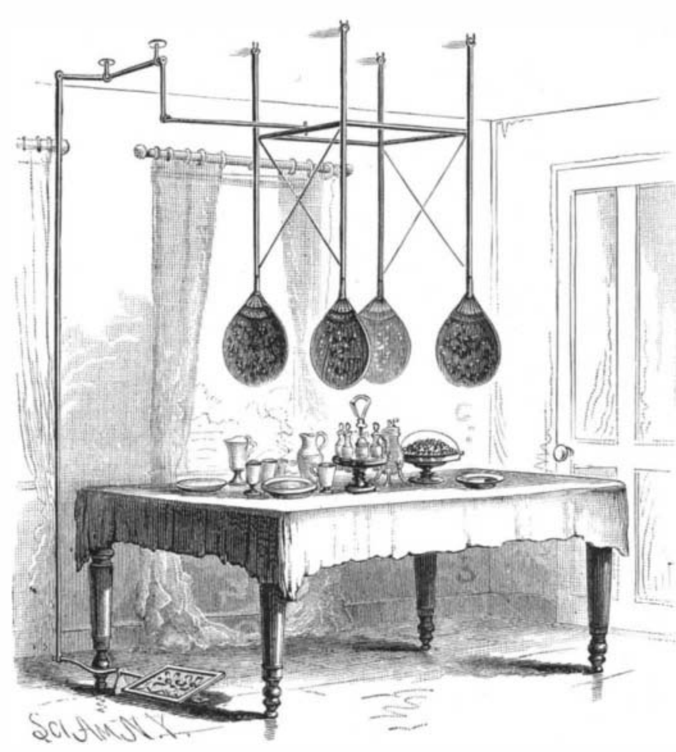
BLAKE'S CLOTHES HORSE.

this construction permitting the frame to be folded so that the side bars will rest side by side. The frames are secured to each other by hinges, and the center side bars are provided with branching legs—shown clearly in the right hand view—upon which the device will stand when so folded up that the other side bars will not extend below the center ones. The device may also be folded up as shown in the left of the engraving.

Made in this manner the clothes horse is cheap and durable, and when extended can be made to assume almost any desired position, and when folded occupies but little space. When closed, the center bars are held together by a hook and eye.

IMPROVED FAN ATTACHMENT.

The fan attachment shown in the accompanying engraving is the invention of, and is now being manufactured by, Messrs. A. O. Williams & Co., of Nos. 5 & 7 College St., Nashville, Tenn. A treadle is attached to one end of a lever, from the other end of which a rod extends upward and unites with



WILLIAMS & CO.'S IMPROVED FAN ATTACHMENT.

an arm of a bent lever fulcrumed on a hanger depending from the ceiling of the room. The lower arm of the bent lever connects with swinging rods suspended from screw eyes made fast in the ceiling. These rods are connected by horizontal bars from which the fans hang—the joints being loose so that the fans, which are rigidly secured, may move freely in a horizontal plane. By placing a foot upon the treadle, any one sitting at the table can transmit motion to the fans through their connections, so that flies will be driven away and the air agreeably moved. The device is simple, cheap, and easily set up and operated, and by its use in warm weather the pleasure and comfort of those at the table can be greatly augmented.

Glass from Bradford Rocks.

It was practically demonstrated yesterday afternoon (May 19) that the manufacture of glass from Bradford sand rock through the agency of natural gas is entirely feasible, and our initial glass industry must prove an opening wedge to kindred enterprises which must redound to its credit. A curious crowd gathered at the works yesterday and watched the blowers skillfully gather the molten bolts of glass from the pots and blow huge cylinders, which after passing through the annealing oven will as sheets be cut into window panes. Of course, on a "first performance" of this kind there are numerous little details to be arranged, and it is difficult to speak advisedly of the full measure of success achieved, but its result is regarded as highly satisfactory. In a few days everything will probably be working smoothly, and visitors will see much to interest them. Superintendent McCartney and a number of glass blowers, with several samples of the work in the shape of globes, cylinders, and canes, marched to the Riddle House and received the congratulations of the crowd. Thirty carloads of window glass have already been ordered from the Bradford glass works, and this may be considered as merely an earnest of what will be required should reasonable expectations be realized. The first product of the works will be used in the windows of the buildings. An eight-pot furnace is now in operation, and the ground is laid out for another of the same capacity. The gas fuel works splendidly, producing a most intense heat and fulfilling every requirement.—*Pittsburg Era.*

Goods Duty Free into Mexico.

Under the new reciprocity treaty between the United States and Mexico, the articles enumerated below are to be admitted free of duty into Mexico:

Accordions and harmonicas; anvils; asbestos, for roofs; agricultural knives, without their sheaths; anchors, for vessels, large or small; apparatus of all kinds for industrial, agricultural, and mining purposes, sciences and arts, and any extra separate parts and pieces pertaining thereto; bars of steel for mines, round or octagonal; barrows and hand trucks, with one or two wheels; bricks of all kinds; books, printed, unbound or bound in whole or part, with cloth or paper; beams, small, and rafters for iron roofs; barbed wire for fences, and the hooks and nails to fasten the same; coal, of all kinds; cars and carts, with springs, two wheels, four wheels, small hand; coaches and cars for railways; crucibles and melting pots of all materials and sizes; cane knives; clocks, mantel or wall, fine and ordinary; carriages and diligences of all kinds and dimensions; dynamite; fire engines; fire pumps; faucets; fuse and wicks for mines; feed, dry, and straw; fruits, fresh; firewood; guano; hoes, mattocks, and their handles; houses of wood and iron complete; harrows; henequen bags, on condition that they be used for subsequent importation with Mexican products; ice; iron and steel, made into railways; instruments, scientific; ink, printing; iron, beams; instruments of iron, brass, or wood, or composed of these materials, for artisans; lime; locomotives; lithographic stones; masts for vessels; marble, in blocks; marble, in flags for pavements, not exceeding 40 centimeters in square, polished only on one side; machines of all kinds for industrial, agricultural, and mining purposes, sciences and arts, and any separate extra parts and pieces pertaining thereto; metals, precious, in bullion or in powder; money, legal, of silver and gold of the United States; moulds and patterns of the arts; naphtha; oats, in grain or straw; oars, for small vessels; pumps, ordinary, for irrigation purposes; pickaxes; plows and plowshares; paper, tarred, for roofs; plants of any kind not growing in the country, for cultivation; pens of any metal, not silver or gold; petroleum, crude; petroleum or coal oil and its products, for illuminating purposes; powder, common, for mines; quicksilver; rakes; rags or cloth for the manufacture of paper; roof tiles of clay or other material; sickles; shovels; spades; seeds, of any kind not growing in the country, for cultivation; sulphur; stoves, of iron, for cooking and other purposes, with and without ornaments of brass; staves and headings for barrels; steam engines; soda, hydrosulphate; sewing machines; slates, for roofs and pavements; sausages, large or small; teasels of wire, mounted on bands for machinery, or vegetable teasels; types, coats of arms, spaces, rules, vignettes, and accessories for printing of all kinds; vegetables, fresh; wire, telegraph, the destination of which will be proved at the respective custom houses by the parties interested; wire of iron or steel for carding, from No. 26 upward; water pipes of all classes, materials, and dimensions, not considered as comprehended among them tubes of copper or other metal that do not come closed or soldered with seam or with riveting in all their lengths; window blinds, painted or not painted.

Fast Speed Telegraphy.

Speaking of a recent contest among Morse operators in London, the *New York Operator* says: "We are willing to admit that England can produce as fast operators as we can, but we claim that with their lumbering code of signals as against our rattling combination we can beat them, everything else being equal. We have sworn records of fast Morse sending at the rate of forty-two words a minute for sixty consecutive minutes—over 2,500 words in one hour.