of a vivid reminiscence of the "Great Expounder's" matchless oratory.

AN INGENIOUS MECHANICAL DEVICE,

whereby the reciprocating of a piston is transformed into rotary motion, and the piston at the same time oscillated on its axis, exists in the Russian valveless engine. As represented in our sketch, there is an arm attached rigidly to the piston rod, and having on its end a ball which enters a socket near the periphery of a disk. The latter answers for a flywheel, and is rotated by the arm as the piston rod reciprocates, while the rod itself is vibrated. The effect of oscillating the piston is to open and close the steam valve passages suitably arranged therein.

We have hitherto labored under the idea that in ingenious combinations of furniture our American inventors excelled the rest of mankind. But now we doubt it. There is an exhibitor from the Argentine Republic from whom our inventors may take lessons. He contrives to stow more utterly diverse articles into a smaller space than any one we ever saw; his furniture is at once a puzzle and succession of surprises. No drawing would do justice to the principal object which he displays. It is a dressing case which contains everything in the housekeeping line, from a coal cellar up. There are places for utensils, for blacking boxes, for cigars, hair brushes, garments, gas stoves, provisions; and the rest a New York *Herald* exploring expedition might profitably be fitted out to discover. If there is a cradle and baby tender also combined, and we dare say there is, the young housekeeper needs nothing more to complete her *ménage*. For people who have no fixed abode, but who "live in trunks," this South American inventor provides a less complicated but none the less ingenious combination, which is depicted in our sketch. To begin with, there is a trunk about as large as the average "Saratoga," presenting nothing remarkable in aspect except an exterior strength calculated to defy the most persistent baggage smasher. You seize the top, throw it over sideways in two portions, lift up and open out the back part, and behold the trunk is a comfortable lounge. Where are the garments? In the drawers under the seat, which the fall of a false front piece reveals. Is a table needed? A flap hung to the back is raised and firmly supported by props. One arm may be developed into a writing case with all the appurtenances, the other into a dressing box containing all the toilet articles. The empty spaces in the lid are to be utilized. Step around to the rear, pull on a couple of knobs, and there are two small tables set with plates, knives, forks, tumblers, napkins, and all the *et cæteras*. That trunk is an exposition by itself.

THE CALIFORNIA MAMMOTH GRAPE VINE

is exhibited in Agricultural Hall, and is probably the largest vine in the world. It has produced yearly 12,000 pounds of the variety known in California as the Mission grape. It was planted by Doña Maria Marcelina de Dominguez, according to the custom of the country, at the birth of a child, some sixty years ago. For several years it has shown signs of decay, and was dug up, sectionized, and boxed for removal to the Exposition. There the sections are bolted together, and the vine is set up as nearly as possible in its natural position. It is, of course, very irregular in shape, so that no definite dimensions can be given. The size of the trunk can, however. be estimated from that of the figure represented beside it.

Correspondence.

Boiler Explosions.

To the Editor of the Scientific American:

In the last number of the SCIENTIFIC AMERICAN I read your notice of a disastrous boiler explosion at Pittsburgh, Pa., in which you state that "no cause is yet assigned for the casualty," and that 'the boilers were inspected some five weeks ago, and were then in good condition." There has been much argument on the subject of boiler explosions; and from an everyday experience of nearly forty years in the construction and management of steam boilers of various kinds, I will venture to give you my opinion on the subject, although I shall differ from many.

In the first place, I think there is one, and only one, cause of boiler explosions. and that is the want of a sufficient quantity of water. But a boiler may be burst from many causes. You will see here that I draw a distinction between the explosion and the bursting of a boiler. An explosion is an expansion with great force, followed by a violent report, and a burst is simply a liberation from confinement, without the great force and violent report of the explosion. Bursting may result from various causes, such as a weak or defective boiler, an over pressure of steam, or water, or air, as the case may be. A boiler may be made defective in several ways. First, by letting dirt and sediment collect on the bottom of the boiler, which is directly over the fire. Boilers can be and are very frequently burnt entirely through in this way. Second, by using inferior qualities of iron in the construction. Third, by poor riveting. Fourth, by injury in testing, by subjecting the boiler to more pressure than the iron is capable of bearing. Fifth, by freezing. Sixth, by the present ruinous practice of blowing the water out of the boiler under a pressure of steam, and while the fire box or bridge wall is still hot. The consequences of this practice are cracked sheets, broken rivets, grooving, etc. Moreover the dirt and sediment dry and adhere firmly to the iron, and form a crust or scale; while if the water was drawn off cold, the sediment would be soft, and the most of it would be drawn off with the water, or at least could be washed off.

A boiler may be burst either by steam pressure or hydrostatic pressure, and the destruction of property be the same; but of course life would be endangered by scalding water and steam. The bursting of a boiler makes little or no report, no more than the opening of a safety valve or a blowing-off valve. But a boiler is seldom allowed to burst, as timely notice is usually given by the leakage of steam and water from the defective part. Not so with an explosion. This agent of destruction never seeks the weak places of a boiler; and the strength and thickness of a boiler has nothing whatever to do with its explosion. In fact the stronger a boiler, the more terrific the explosion, and the more disastrous will be the effects. And as far as boiler inspectors are concerned, they can pronounce a boiler good or bad, and determine its liability to burst, but that can do no good in preventing its explosion. That depends wholly on those having it in charge.

Boiler manufacturers are often and unjustly blamed for the explosion of a boiler which, I repeat, can only occur from the want of a sufficient quantity of water, caused by the carelessness or inexperience of those in charge of it. If employers were more careful to secure competent engineers, there would be fewer explosions. There need be none.

L. B. DAVIES.

[For the Scientific American.]

THE MERITS AND DEMERITS OF LINNÆUS.

To the great Swedish naturalist Linnæus, who was born in the year 1707, belongs the honor of having first originated a system of classification of the vegetable and animal kingdoms, which system (although Linnæus himself remained perfectly orthodox, believing in the theory of special creations) contained in itself the germ of the evolution doctrine, now grown to such mighty proportions. In regard to the account of the creation given in the book of Genesis, we must (with Haeckel) acknowledge that it reveals two grand fundamental ideas, namely, differentiation and progressive development of the matter "created" "in the beginning." Together these form a grand conception. perhaps, far more important to the truth of the narrative than the now ascertained error of considering this little earth as the center of the Universe, around which sun and stars revolve. This error was confuted by Copernicus, Galileo, and their successors. Another important change in the popular ideas of creation, namely with regard to the position of man in the whole scheme, has been effected by Lamarck, Darwin, and others. It is strange that theologians should so frequently, as they do, content themselves with asserting the literal accuracy of so ancient a book as the Bible, which has suffered severely by the course of tradition and the vagaries of translators, in place of confining themselves to the grand moral lessons and the pure religious principles it inculcates. The Bible is not a text book of natural science, nor has it ever pretended to be one.

The great progressive step made by Linnæus was as simple as it was rich in results. It was the designation of each plant and animal by two names. The first, the genus, was given to each family of plants or animals; while the second, the species, gave greater definition and more individuality to each single plant or animal. Thus, for instance, he included all animals resembling the tiger, whether large or small, under the genus *felis*, and he used the name for the whole class; and he added a second name for the species to which the animal belonged. Thus, he called the common tiger *felis tigris*, the lion *felis leo*, the panther *felis pardus*, the jaguar *felis onca*, the wildcat *felis catus*, and the house cat *felis domestica*. This method was perhaps suggested to him by the custom in society of having family names and baptismal names, by which members of the same family may be distinguished. Before the time of Linnæus, the different names of the individual plants and animals formed a perfect chaos; but the dual nomenclature not only necessitated a classification, but became its basis. The two names soon proved the value of the system, as by them attention was drawn to the similarity and relationship between the various plants or animals. Linnæus in fact attempted to complete the whole system, and divided, for instance, the whole vegetable kingdom into 24 classes, which he subdivided into orders, these into genera, and these again into species. He divided the animal kingdom into 6 classes, which were again subdivided into many orders, genera, and species. Notwithstanding that his classification has been modified, and has been based on facts since ascertained to be more fundamental than those on which he grounded his theory, the honor of the reform belongs to him: although he was often in doubt, especially whether some particular animal had to be considered as a separate species, or only as a variety of the same species. He even went so far as to admit that hybrids may constitute the origin of new species, and even that a great number of new species had originated by the interbreeding of other species. This opinion was very remarkable as that of a man who had already accepted the theory of the miraculous creation of every species; and it would have been in direct contradiction to his creed, were it not that he had claimed as an exception to the rule that some species were originated by hybridism or incidental changes: and all that Lamarck and Darwin did was to extend Linnæus' exceptional theory to the origin to all species whatsoever.

In regard to the origin of the distinct species, Linnæus, as before remarked, believed in special acts of miraculous creation, and adhered strictly to the Mosaic account, according to which plants and animals were created by God, "each after its own kind." Linnæus expanded the idea, and went into details, expressing the belief that, originally, either a single individual or a pair of each animal or plant had been created. He believed that "man and wife created He them" of every species which exists in two sexes; however, in those cases where every individual is possessed of both sexual organs, as is the case with many kinds of snails, worms, parasites, and the majority of plants, Linnæus believed that God created only one individual, as this was sufficient. Linnæus further believed that, in the deluge, all the then existing organisms were drowned, except the few individuals of the various species which were saved in Noah's ark, and afterwards put ashore on Mount Ararat. The geographical difficulty of widely differing animals and plants living together when put ashore, he explained by the fact that Ararat, in Armenia, is situated in a warm climate; and being more than 16,000 feet high, it unites in itself all the conditions for affording diversity of climate to suit animals of different zones. The animals accustomed to the climate of the polar regions, such as polar bears, could therefore at once ascend to the cold snow-covered summits; those accustomed to a warm climate could go to the foot; while the inhabitants of the temperate region could remain where they were, half way up. From this mountain, he asserted, the animals distributed themselves afterward again over the whole earth.

Haeckel makes a serious objection to the possibility of existence of a single pair of animals of each kind at the same time. He says that, for the first few days after the creation or after the deluge, the carnivorous animals would have eaten all the herbivorous cattle, the lions and tigers would have eaten the single pairs of sheep and goats in existence; while the herbivorous animals would have eaten as once all the single plants before there was a chance of propagation. Certain it is that the balance in the economy of Nature, such as we see it now, could never have existed if only one single pair of each species had been created at the same time. It is seen, then, that the hypothesis of Linnæus is scarcely worth a serious discussion; and when we consider that he had a clear head and excellent reasoning powers, it is indeed very doubtful if he could believe in it himself.

This hypothesis prevailed, however, for about a century without being disputed; and this was perhaps partially due to the merits of Linnæus as a naturalist, and the great renown he had earned by his systematic description of the works of Nature. This, added to the prevailing idea of considering the Bible to be intended to teach the sciences, retarded the acceptance of sound and correct ideas concerning the institution of the Universe.

In closing this review of the merits and errors of Linnæus, we cannot abstain from expressing our surprise that Professor Huxley, in his recent lectures in this city, selected Milton in place of Linnæus as the defender of the six day miraculous creation. Milton should be considered by every one as drawing on his imagination, and availing himself of poetical license to the fullest extent. He was no scientist, but a poet; and he should on this account not be held responsible for his *quasi* scientific opinions. But Linnæus was a scientist, and his opinions, hypotheses, and theories fall within the pale of scientific criticism: and he was especially scientifically definite in all he said and wrote. If Professor Huxley selected the poet because everybody knows Milton and his works, we may suggest that some information about the great naturalist Linnæus and his services to Science would have served the purpose, of bringing out the truth of the evolution theory, far better than the beautiful poetical dreams of "Paradise Lost."

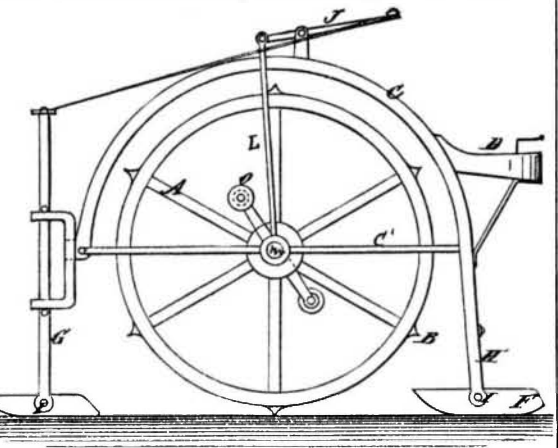
P. H. VANDER WEYDE.

The Thirty-Eight Ton Gun.

For some little time past a substantial target has been in course of erection on the experimental grounds at Shoeburyness, England. The object of this structure was to ascertain the measure of power of the 38-tun 12½-inch gun at the muzzle. This object was satisfactorily accomplished on Wednesday afternoon in the presence of a large number of officials connected with the War Department, besides officers of both branches of the service. The target was composed of three plates of John Brown and Company's make, each plate being 10 feet wide, 8 feet high, and 6¾ inches thick. Between the plates were 5 inches of teak packing, bringing the total thickness of the target to 20¼ inches. The plates were bolted together in couples, the first to the second and the second to the third, with sixteen 3 inch Palliser bolts. The target was supported in the rear by horizontal and vertical bracing formed of 14 inch square timbers with raking struts abutting upon piles of the same scantling, the latter being stayed against an old target. At the side of the target were placed some old 6 inch armor plates on end strutted with timber, and on the top were some old 8 inch plates tied back to the target with old railway bars. A trial shot was first fired at an old 10 inch armor plate with a charge of 130 lbs. of 1·5 inch cube powder and an 800 lbs. Palliser shell made up to weight with sand. The shell struck the plate with a velocity of 1,436 feet per second, punched a clean hole through it, snapped short a 14 inch pile a couple of feet behind it, and broke up against an old target. The round against the new target was fired with a similar charge to the foregoing, the range being, as before, 70 yards. The shot, which had a striking velocity of 1,421 feet per second, punched a clean hole 13 inches by 12½ inches in the front plates, and passed through the middle into the rear plate, where it broke up. The base of the shot with a portion of the walls was left in the hole, but the point, with 9 inches of solid metal, struck against the rear target some 10 feet off. and rebounded to a distance of 20 feet to the right proper of the target. The rear plate was considerably buckled, but the iron around the shot hole was not cracked or started, the metal showing a fibrous fracture bespeaking its high quality. The timbers were considerably started, a pile next the target in the rear to the left proper being sheared clean off. In fact the proper side of the target was thrown back about 7 inches, and, of course, it generally suffered severely. The results as regard penetration were such as had been anticipated by the Heavy Gun Committee, so that practice here has satisfactorily confirmed theory, and has afforded data of considerable value to the authorities.—*Engineering*.

NEW ICE VELOCIPEDE.

In the annexed illustration is represented a novel ice velocipede, invented by Messrs. Juan Arnao and Juan Arnao, Jr., of Brooklyn, N. Y., and patented through the Scientific American Patent Agency. A represents a drive wheel, having points, B, on its periphery, and arranged on a shaft that



is journaled in two longitudinal springs. C is the frame, and D a seat located on its rear so that the rider may conveniently operate the foot cranks, O. H are rear bifurcations of the frame, to whose lower ends are pivoted the runners, F; while G is an independent standard, swiveled in the front of the frame, and connected, by cross pieces and cords, with the front end of a lever, J. This enables the rider to guide his velocipede with great facility. The lever, J, is pivoted to a stud on top of the frame, so as to bring its power end near the driver, and is connected at the other end, by pivoted rods, L, with the drive shaft. By this arrangement the driver can readily lift the wheel from the ground at any time, and the runners are enabled to pass over small obstructions on the ice.

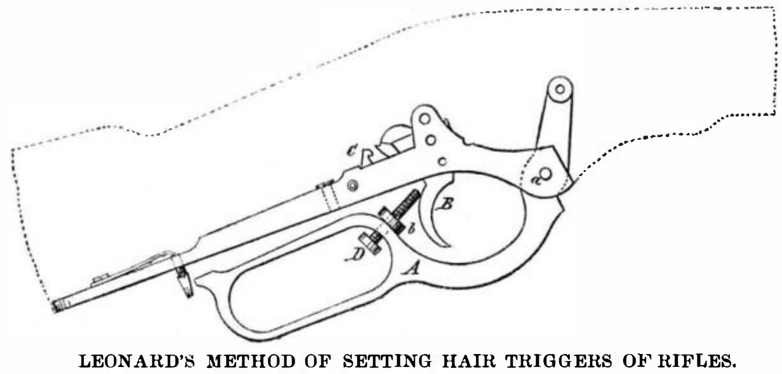
A Solar Distillery.

M. Mouchot, whose steam boiler, heated by the sun's rays concentrated by a concave mirror, we described not long ago, recently exhibited to the French Academy of Sciences a new apparatus whereby by solar heat he distilled excellent brandy. The mirror was but 19·5 inches in diameter. A little over a quart of wine was placed in the boiler, and brought to boiling for 15 minutes by the concentrated rays. The alcoholic vapor entered a tube placed in the center of the boiler, traversed the supporting foot of the mirror, and descended into a room, where it condensed. The liquor was of remarkably good flavor, free from the disagreeable taste of alcohol peculiar to that obtained from wine in the usual way, and savoring strongly of the best cherry brandy.

M. Mouchot afterward placed flowers and odoriferous leaves in his boiler, and made a variety of perfumes and essences. Finally leading the steam into a cooking apparatus, he prepared an entire dinner by the agency of the sun's heat.

NEW METHOD OF SETTING HAIR TRIGGERS OF RIFLES.

This is a timely invention, which will interest riflemen and the many amateurs who are engaged in the laudable effort of attempting to rival the famous scores mde by the international teams at Creedmoor recently. The usual manner of setting the set trigger is to throw the trigger, B, in the engraving, forward with the thumb. This operation requires both time and some exertion, and the present device is intended to obviate the difficulties. Referring to the engraving, which is a side elevation, A is a finger lever, which is pivoted to the lock at *a*, in the usual manner. B is the trigger, and C the set trigger D is a milled head screw, which runs through the finger lever to a point near the trigger, and is capable of moving the trigger sufficiently to set the set trigger, C, when the finger lever, A, is moved either away from or toward the rifle stock. *b* is a jam nut placed on the screw, D, that bears on the finger lever, A, to prevent the screw from turning when once adjusted. The rifle can then be discharged with greater rapidity and with less exertion.



LEONARD'S METHOD OF SETTING HAIR TRIGGERS OF RIFLES.

The device was patented through the Scientific American Patent Agency, September 5, 1876, by Mr. George O. Leonard, of Red Bluff, Cal.

What a Patent Agent Ought to Be.

A patent agent ought to be careful and honest, because he is the repository of his clients' secrets. No class of property is more highly valued by its possessors than that which derives its origin from invention. No matter how trifling the idea may be, the person who conceives it is apt to place a much higher estimate upon its value than others, and he is therefore jealous of its possession. This jealousy is excusable, however, on account of the fragile nature of the tenure by which he holds possession, and because his title cannot be permanently established until the patent is actually allowed and issued. An improper exposure or unwise placing of confidence in a third party by the inventor or his confidents is liable to, and often has, cost the inventor not only time and money to obtain his rights, but has entailed the entire loss of his invention.

It is therefore necessary that the patent agent should not only have the confidence of the inventor, but that he should carefully guard the interest of his client and see that no injudicious exposure or explanation is made that parties liable to create trouble can get hold of. The utmost confidence ought to be maintained between an inventor and his attorney or agent.

A patent agent ought to be patient. Inventors are proverbially tedious. They like to talk about their inventions especially to the person whom they have employed to prepare their patent papers and attend to prosecuting their applications. This is also excusable, because it relieves the mental pressure. It is the inventor's safety valve. Fear of exposing his secret to others compels him to keep it locked up in his brain; and there it lies, unfolding itself, expanding in value and importance and permeating every tissue of the human anatomy until the accumulated pressure is relieved by a distribution of the burden with a confidant, and the patent agent is usually that confidant.

The agent should patiently listen, for the talk of an inventor is valuable to him. It gives him the inventor's peculiar ideas; and if he is a student of human nature, it enables him to frame the case so that the inventor will be satisfied with it in every particular.

The patent agent should be accommodating. Inventors are often whimsical; the very nature of their undertaking is apt to lead them to peculiar theories and incorrect conclusions, although the general result of their theories and conclusions may be correct. These theories the agent must not combat, unless they are vital and enter into the essence of the case. He had better let their possessor retain them than incur his distrust and possible enmity by opposing them. The inventor will find his errors when he comes to enter upon the actual and practical field of operation.

The patent agent must be familiar with the law of patents; otherwise how can he guard the vulnerable points of the invention? Every specification must be prepared with a view to its having to pass at some time or other through the ordeal of a judicial examination, and a judgment as to its validity and scope; and unless the person who prepares the specification fulfills the legal requirements, and in a legal manner sets forth the description and claims, the patent will not stand.

No general knowledge which he may possess will make up for the want of legal knowledge: this want is the one thing that may defeat the end sought, and the knowledge must be properly possessed and properly employed.

The patent agent must be a mechanic, theoretical, at least. In this particular, a patent agent must be qualified by nature, and not by education, although education is necessary to enable him to dress his mechanical points in proper language and render his points plain, certain, and intelligible. Technical knowledge of each particular art, trade, or profession is not required, but a general knowledge of the various steps and requirements is necessary. A person who possesses the inventive faculty, if otherwise qualified, makes the best patent solicitor; he can then see each invention through the same medium and in the same light that the inventor himself sees it; he can pick out and embody the small mechanical points that form the real safeguards of a patent, and thus more absolutely prepare the case for the scrutiny of judicial investigation and the criticism of mechanical experts.

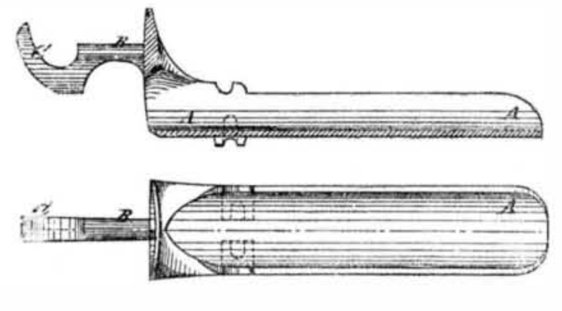
Few men possess all of these qualities, therefore we might say that few men are competent to serve as patent solicitors. The want of proper qualifications in patent agents is the cause of so many worthless patents being issued from the Patent Office. The inventor must absolutely depend upon the preparation of his case for his security and defense, and it therefore behooves him to examine into the character and qualifications of the person in whose hands he places his invention and secret.

The safest and best guide for inventors who require the services of a patent agent is to choose those who have been long in the business and who have acquired a settled reputation for integrity and capacity. Mushroom patent agents exist everywhere. They employ the most specious means to entrap the uninformed inventor, but their services are an actual damage nine times out of ten. It is a hundredfold cheaper to pay a competent attorney or agent a fair fee than to accept the services of such men for nothing.—*Mining and Scientific Press.*

TO PURIFY glycerin, add 10 lbs. iron filings to every 100 lbs. glycerin. In a few weeks all impurities will lay at the bottom.

IMPROVED SAP SPOUT.

Mr. Hiram A. Lawrence, of West Shefford, Quebec, Canada, has patented through the Scientific American Patent Agency, September 12, 1876, an improved sap spout, which may be applied to the tree without pounding, and, consequently, without injuring the bark: which will prevent leakage, cannot be forced out by the sap freezing in the hole, and which cannot be drawn out or loosened by suspending a bucket from it. The body of the spout, which is of iron, is made in the form of a half tube. At the base the sides of the spout are extended up to meet above the cavity, as shown in the engraving. The hole in the tree is made of such a size that the stem, B C, can be inserted in it by raising the outer end of the spout. When the stem has been pushed so far into the hole that the upper part of the base of the spout strikes against the bark of the tree, the outer end of the spout, A, is then pressed downward. This forces the transverse edge of the end of the hook, C, into the upper part and the longitudinal edge of the base of the



hook, C, into the lower part of the hole in the tree. At the same time, the edge upon the base is forced into the bark of the tree around the lower part and sides of the hole, so that there can be no leakage.

Solvent for Rubber.

This new solvent consists of a mixture of methylated ether and petroleum spirit—the common benzolene used for burning in sponge lamps. This forms the most rapid and, perhaps, the best solvent we have tried; the mixture is as much superior in power to either of its constituents singly as the ether-alcohol is to plain ether in its action on pyroxylin. We make a very thick solution by dissolving sixty grains of good india rubber in two ounces of benzoline and one ounce of sulphuric ether. If the india rubber be cut up fine and the mixture shaken occasionally, the solution will be complete in two or three hours, when it may be diluted to any required strength with benzoline alone. The india rubber should be as light colored as possible, and all the outer oxidized portions must be cut away. Shred the clean india rubber with a pair of scissors, and throw it at once into the solvent.—*British Journal of Photography.*

Wood Pulp.

Many substitutes for cotton wool have been proposed for the making of pyroxylin, such as linen rags, sawdust, flax, paper, etc., the last-named material alone being the on'y one used practically, though it is by no means certain that sawdust might not supply a good pyroxylin with organic reactions for special purposes. But the most promising material of all is offered in cellulose prepared from wood, which is now made for the paper manufacturers in very large quantities. The mechanical wood tissue obtained by grinding wood does not answer their purpose at all; but the cellulose prepared by chemical means is a substance whose qualities render it suitable for the manufacture of the highest quality of paper. So far back as 1868, a company made paper from this material alone, without the addition of rags. Three years afterwards five large mills were started (by an English company) in Sweden; and in Germany, at the present time, there are six factories in which the same process is carried out. It is somewhat as follows: The wood of pine and fir trees (oak is of no use what ever) is cut into small pieces a little less than an inch long by half an inch wide and a third of an inch thick, which are then comminuted by passing them into a machine very like a large coffee mill. It is then boiled, under a pressure of ten atmospheres, in a solution of caustic soda for about four hours. The residue is well washed, bleached, pressed, and lastly dried and cut up into sizes suitable for packing. It is also sent out unbleached, in which form it is used for a variety of purposes, besides making brown paper. This is the form we should be inclined to think would be most suitable for the manufacture of pyroxylin. The greatest demand hitherto has been in Germany and Austria, the former country producing, it is estimated, 250,000 tuns of paper a year, and Austria about 100,000 tuns. If only one fifth part of this be made with cellulose, that would mean 70,000 tuns of this material, which would require 280,000 tuns of wood for its production.

REMOVING SUBSTANCES FROM THE EAR.—Take a horsehair, about six inches long, and double it so as to make a loop at one end. Introduce this loop as deeply as possible into the auditory canal, and twist it gent y around. After one or two turns, according to the originator of the plan, the foreign body is drawn out with the loop. The method is ingenious, and at all events causes little pain, and can do no harm.—*Medical Record.*

THE Amazon river drains 2,500,000 square miles of land, and is navigable for 2,200 miles from its mouth.