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FRIEDMANN'S EJECTOR.

We give herewith an engraving which will afford an idea of some of the uses to which the ejector is applied. It is not only very simple, but one of the most effective machines within recognized limits, for raising water and conveying liquids rapidly and economically by steam, that has yet been invented, and in many instances the only one that can properly do the work.

It is applicable in a great variety of forms for raising water and other fluids from tanks, wells, ponds, mines, quarries, holds of vessels, docks, gas works, wheel pits, and it is also well adapted for conveying liquids, of various degrees of consistency, from tank to tank or floor to floor in breweries, chemical works, distilleries, sugar refineries, and other similar establishments.

In outward appearance the ejector is a cylinder of irregular form, varying in length from 6 inches to 3 feet, according to size and capacity, and in circumference proportionately to its length. There are three apertures in each machine, one for steam, one for suction, and one for discharge, that which admits steam being much smaller than either of the other two.

The sectional engraving at the top conveys a clear idea of the internal construction of these ejectors and reveals at once to the mechanical eye the secret of their power. It will be perceived that they are provided with a series of intermediate nozzles or cones, firmly fitted to the body of the ejector, by which the water from the suction pipe is admitted to the receiving chamber in successive streams.

The great utility of this arrangement (which is the vital principle of the ejector) lies just here. In the ejector the steam jet acts at first only on that portion of the incoming water which is admitted through the first nozzle or cone, so that only a comparatively small jet of steam is required to move it. This stream, propelled by the force of the steam, gives an impetus to the water entering through the second cone, and that in turn becomes a motor to the next, and so on until the last is reached. The water or liquid, accelerated in its passage through these successive nozzles or cones, as well by the force already described as by the vacuum always formed under such conditions, is carried with great velocity through the diverging pipe into the discharge pipe, with all the force and rapidity necessary to convey it to its required destination.

As a means of ejecting water in sinking shafts and cross-cutting drifts these ejectors are valuable, as they can be adjusted to the work, as it progresses, by simply lengthening the piping, the slow process of keeping the water free by means of buckets or bailing out being thus dispensed with.

The lower right hand view in the engraving gives a general idea of the operation of the ejector in shallow mines or coal pits, where the depth is not more than 100 feet.

The upper right hand view shows the ejector placed on the bank of a lake, river, or pond, 10 to 15 feet above the level of the water, for raising water for irrigation and other purposes. The large central view shows the ejector as applied to the filling of locomotive tanks from a river, pond, or ditch; and the view immediately below it shows the application of the ejector as a bilge pump. In view of their complete adaptability to this kind of work, and their ability to keep ships clear of water in case of accident from shot or shell, or leakage of any kind, the French, Austrian, Russian, Italian, Belgian, and other navies have provided their men-of-war with them.

We are informed that the British navy have also adopted

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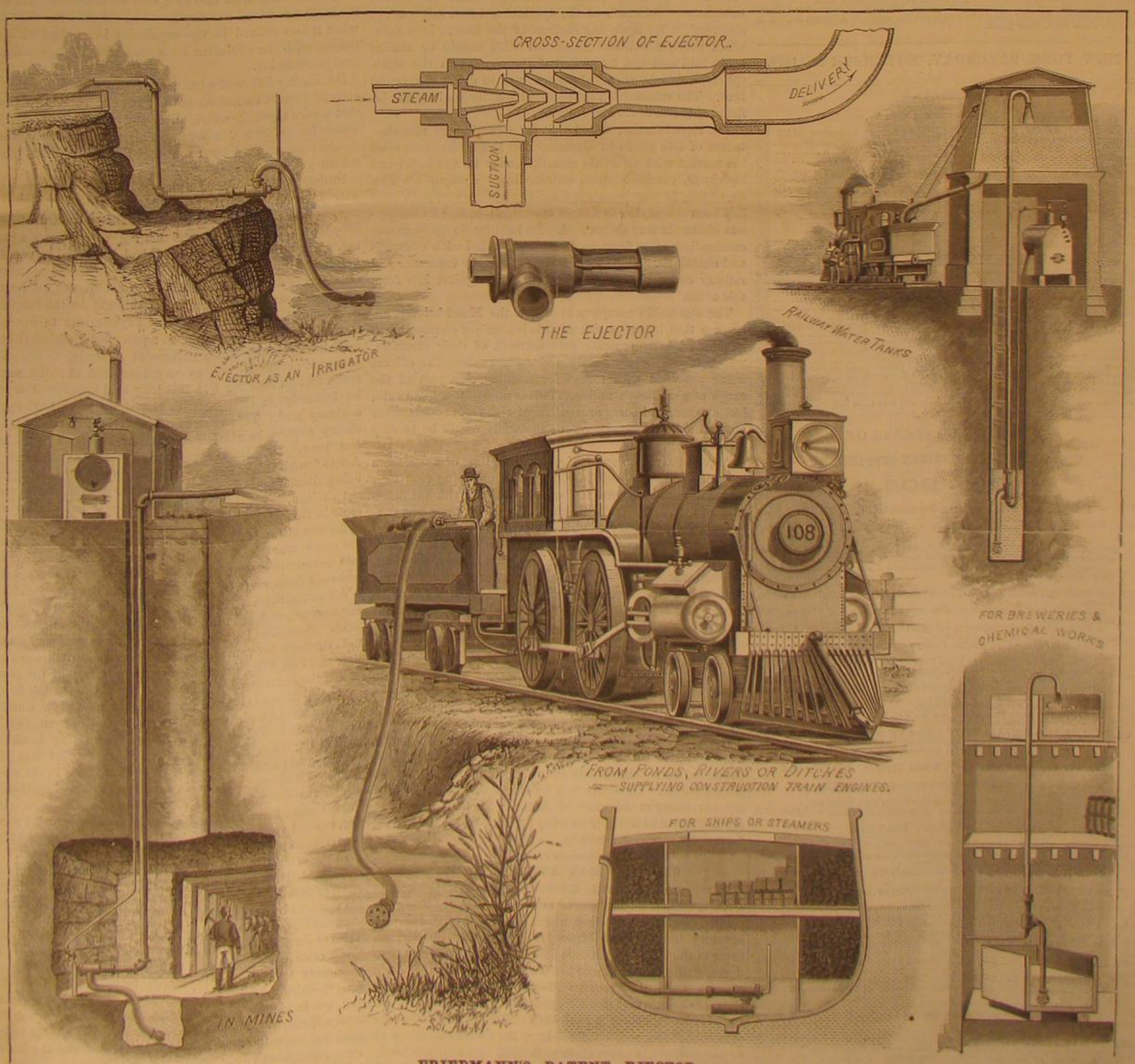

FRIEDMANN'S PATENT EJECTOR.

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NEW YORK, SATURDAY, NOVEMBER 22, 1879.

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VIII. BIOLOGY.—The Beginnngs and the Development of Life. By Prof. EDMOND PERRIER. (Continued from SUPPLEMENT No. 202.) The life history of sponges.—Fig. 1, the larvæ of sponges.—Fig. 2, an absorbent colony of calcareous sponges.—Fig. 3, skeleton of the siliceous sponges, natural size.

INCENDIARY SILK.

The extent to which the adulteration of certain textile fabrics, notably silk and cotton, is carried in many European factories, is little suspected by the buyers of such goods, and it is only by some event outside the regular course of trade that the enormity of the practice is ever brought to light.

Thus, about a year ago, a suit brought in an English court to recover payment for sizing a quantity of cotton, revealed the extent to which that form of adulteration is carried. In the course of the trial the plaintiff was forced to explain that his process of sizing involved the loading of cotton goods with flour, clay, Epsom salts, chlorates of zinc and magnesia, and glue, to the extent of 70 per cent. He had used as high an average as 130 per cent; and he confessed that there were men in the business who loaded their goods with size as much as 230 per cent.

Silk fares even worse. The steamship Mosel, on the way from Bremen to this port, last month, mysteriously took fire in mid-ocean. Fortunately the fire was promptly discovered, and after a hard fight of five hours was put out. When the Mosel reached this city an examination was made, resulting in clear evidence that the fire spontaneously originated in certain silk goods. Samples were placed in the hands of a chemist, who reported that, under the microscope, the silk presented a remarkable appearance. The fibers ran very irregularly, and were partly covered with scales of a metallic luster, while on other fibers heavy sponge-like knots of dark color could be observed. The physical structure of the fiber seemed unimpaired. A careful chemical analysis disclosed that 100 parts of the silk were made up as follows: Moisture, 9·15; pure silken fiber, 21·35; oxide of iron, 13·45; other minerals, not determined, 3·30; fatty oils, 1·85; organic dye-stuffs and coloring matters, 50·90. The silk was free from cotton or wool fibers. For each part of fiber, 0·75 part of oxide of iron and nearly 2·50 parts of organic dyes were used for coloring. The coloring substances for this silk most probably contained tannic acids or similar substances. As much of the dyestuff and iron salt was not absorbed, it lay upon the surface of the fiber. Iron salts, when precipitated and combined with tannic or similar acids, will undergo, by action of the oxygen in the atmosphere, a certain chemical change, and in doing so give out heat. The combustion thus started was assisted by the inflammable silk fibers and fatty oils.

The report further stated that for several years manufacturers of silk goods in Germany and France have supplied the market with an article remarkable for its fine luster and heaviness, combined with extraordinary cheapness. Frequent fires in warehouses and railway cars, where such silks had been stored, led to a close investigation, and its dangerous character was discovered. Its liability to spontaneous combustion arose from its being overloaded with dyestuffs and chemicals. Steps were at once taken by insurance and railway companies to secure themselves against loss from this cause.

The steamship company to which the Mosel belongs announce that hereafter silk of this incendiary character will be stowed in a separate compartment of their steamers, where it can be constantly under observation, the officers being provided with means for flooding that part of the cargo at a moment's notice. This is no doubt a good rule; but a better and surer preventive of risk from spontaneous combustion in such dangerous materials would be to stop buying them.

A gentleman who was in Lyons at the time of a fire, from a similar cause, on the Oder, is quoted as saying that then the matter was brought to the notice of the silk manufacturers in that city. They acknowledged that there was danger from spontaneous combustion in heavily-weighted cord and sewing silk, as instances had been known of its flaming up when thrown in heaps in the factories. They, however, doubted whether there could be any danger in manufactured silk. This, after coming from the dyer, went through so many processes, that they thought all danger was worked out. The gentleman further stated that at one time sewing silk was regarded with such suspicion by the Russian authorities, that its carriage on passenger trains in Russia was prohibited. He stated that the dangerous quality in silk arose entirely from the chemicals used in the dyeing to give it weight. He knew of silk which came from the dyer's with an increased weight of over 275 per cent.

Ladies who complain that American silks do not show the brilliant luster of certain foreign brands, may now estimate the actual percentage of silk in their brilliant but brittle imported gowns. Dyestuffs may be bright of luster, but they are not cheap at the price of silk, nor are they durable or particularly desirable for wearing apparel, let alone any risk from spontaneous combustion.

ORIENTAL SAND AND MUD BATHS.

In many low plains in the neighborhood of the sea, in Greece, immense quantities of sand are constantly being deposited from the inrolling waves, particularly at the promontory Sunium, near Missolonghi, near Corinth, and on some of the islands, as Noxos and Mykone. Professor Landerer, writing from Athens to *New Remedies*, says that these places are visited by persons affected with chronic rheumatism, anchylosis, and chronic synovitis of the knee joint, for the purpose of taking a sand bath. The patients (who are generally of the poorer classes) bury themselves in the sand or cause others to cover them with it, so that only the head, which is covered with a night cap or straw hat, remains free. It is a ludicrous sight to see twenty or thirty such odd looking heads sticking out of the sand. In consequence of the weight and the saline character of the sand, the skin of the patients becomes so red that when they emerge from their sandy bed (which they occupy as long as possible) they look like boiled lobsters. Wooden huts, or tents improvised with oleander and plantain branches, are used as bathing houses, and a piece of bread, some grapes, and a glass of wine, generally constitute the meal of a patient. Direct inquiry of the patients has elicited the fact that the effects of this sand treatment are decidedly beneficial.

Another variety of bath is likewise not uncommon, the so-called "mud bath." In the canals and ditches into which the sea water is allowed to flow, in order to obtain common salt by spontaneous evaporation, a mother water containing chiefly magnesium bromide remains behind, after the crystallized salt has been removed. At the same time, an aluminous mud collects at the bottom. This mother water, together with the mud, is used by patients affected with chronic splenitis caused by the frequent malarial fevers prevailing among the workmen in these localities, and with intestinal infarctions. The method consists in smearing the whole body with the saline mud, and in exposing themselves afterwards to the rays of the sun until the coating has become dry, when it is washed off with the saline mother water. Sometimes both the sand and the mud bath are used locally on a special portion of the body only, as, for instance, the legs or feet.

THE NATIONAL ACADEMY.

The first paper of the last day of the meeting of the National Academy was by Professor Joseph Le Conte, on the glycogenic function of the liver. It was read by Dr. George T. Barker, and was a continuation of the paper read at the previous meeting of the Academy. Dr. Le Conte contended that the chief function of the liver is in preparing sugar to be oxidized in the capillaries, whither it is carried by the blood. He regarded the liver also as a sort of storehouse for fuel; the carbon received one day may be held until the next day, when it is oxidized in the capillaries in contact with the tissues, with the evolution of heat. The paper provoked a lively discussion.

Dr. Barker followed with a brief paper detailing the results of certain variations of Arago's experiment to prove that a wire through which an electric current is passed becomes for the time a magnet. This view was overthrown by the tests applied by Professor Franklin Bache, some fifteen years ago.

Professor Bache placed a piece of cardboard against the wire in such a way as to cut the "magnetic field" containing the filings into halves. Immediately all the filings dropped. The inference was that the wire was not a magnet. The filings, it was believed, had been held in position before the interference of the cardboard in one of two ways: either by their magnetic adhesion to each other, or by the direct support of the currents circulating in the magnetic field. Dr. Barker has made some experiments to disprove these inferences. He employed a powerful magneto electric machine of the Wallace pattern at Ansonia, Conn. The energy it developed was so enormous that at a distance of seven feet an iron bar five feet long held opposite it would be instantly so charged with electricity as to hold up an ordinary nail. This current of electricity would heat to cherry redness in a minute a quarter inch gas pipe three feet long. Dr. Barker performed the "experiment of Arago" with this machine, using a copper wire. Copper, being diamagnetic, seemed not so likely to become a magnet as iron. A five inch iron spike was held below and close to this wire during the passage of the current. The spike was attracted, but not sufficiently to lift it clear. When the spike was touched to the wire, it immediately stuck fast at right angles to the wire. But when the spike was removed from the wire only the thousandth part of an inch, it fell to the floor. This showed that the great energy of the magnetism was in the wire, and not in the surrounding field. Then Dr. Barker had a glass plate prepared with a hole through its center; the wire was passed through the hole and iron filings sprinkled on the surface of the plate. When the current was passed through the wire, the filings arranged themselves in concentric circles around it. Further experiment showed, by reversing the wire current, that in this magnetic field the currents were traveling in circles around the wire. Finally, when the iron spike was held by the head parallel to the copper wire and near it, the spike deflected itself out of the perpendicular in the direction in which these currents were passing around the wire. Dr. Barker considers that his experiments yield conclusive proof that the old view was correct—that the wire through which a current is passing does become for the time a magnet.

In the afternoon, Professor J. S. Newberry, of Columbia College, delivered an essay on the vegetation of the Atlantic coast of North America in the cretaceous era, and illustrated his remarks by an exhibition of fossil leaves from the greensands of New Jersey. No angiospermic leaves appear in the Trias or Jurassic formations, but in the pottery clays of the lower cretaceous they occur in abundance. One trayful of specimens contained only leaves belonging to the salix family—willow leaves, much resembling those of the present day, but in greater variety. The other tray contained the leaves of conifers, many of them beautiful specimens; twigs showing the skin or bark; cones, etc. Some of the leaves were imbricated.

The question to which these fossils give rise is a difficult

one. They evidently are the product of a temperate, not a tropical climate. Now other fossils of the cretaceous era, such as animal remains, indicate a tropical climate for that period. These leaves are from the dawn of the cretaceous, its lower strata, and are very rich and varied. At the present day it would be difficult to find in a large space such a great number of different species of trees as are supplied in cretaceous fossils. There can now be no doubt about the position of these remains, though when the cretaceous flora of this country was first announced it was bitterly disputed. We may suppose that in the dawn of the cretaceous we had a temperate climate here; that our plants went westward and occupied Europe before the tertiary times, certainly before the miocene and the raising of the Alps. After that came the glacial epoch and destroyed that vegetation, though its traces were left in the rocks of Greenland and Iceland. After that, Asiatic flora came to Europe and replaced its vegetation.

Professor Marsh was deeply interested in Professor Newberry's paper He regarded this flora as much older than the lowest cretaceous marl of New Jersey. In that marl we have abundant crocodiles and other remains that render certain the tropical character of the cretaceous era. With regard to the fossil leaves, there had been a similar question once about certain Dakota fossils, including numerous dinosaurs, some of which were 30 feet high, and some no larger than a cat. It was now known that these Dakota fossils were Jurassic. Up to date we know of no cretaceous mammal. This is the most serious break in our palæontological record. Let us hope that in looking for these leaves we may find some mammal, large or small. Several geologists joined in the discussion at this point. Professor Marsh mentioned that he had himself picked up angiospermic leaves in Europe from undoubted cretaceous formation; these were then regarded as a great curiosity. He suggested that perhaps these leaves grew on forests near the tops of mountains, where they would have temperate climate, while it was torrid in the valleys below; and that these fossil leaves had been washed down the mountain sides and sunk in cretaceous swamps at the bottom.

A second paper by Professor Newberry gave descriptions of certain gold and silver deposits in Utah and Colorado. In the limited area which he explored of the Horn Silver Mine, in Utah, there was not less than $20,000,000 of ore in sight. Specimens of sulphate of baryta with ruby silver were exhibited. The sandstones are full of the impressions of plants; the plants themselves have been removed and the vacancies filled with horn silver. It is said that there is no parallel instance of such impregnation, but he has seen similar cases with copper ores in New Jersey.

Mines in the neighborhood of the Horn Silver Mine were almost equally rich in argentiferous galena, worth $50 to $60 per ton. Recently a similar deposit, the Silver Cliff Mine, has been found in Colorado. The district is also of archendrite rock and trachyte. A man named Bassick, a sailor, who had wandered around the world, was reduced to his last cent in this region, and was living on "tick." He picked up a mass of the rusty conglomerate rubbish, and got somebody to assay it. The yield was $50 to the ton. The chemical history of these balls of trachyte is that they were boiled and softened, when silver ore floated into their crevices or coated their surfaces. There is found silicified wood at a depth of 150 feet. Bassick proceeded to work his mine, and eventually sold out for a round $1,000,000. Silver Cliff is a hill of ore about six miles away from the Bassick mine. From another locality arsenic ores were exhibited, and it was stated that there—"the Lucky Boy's Mine"—orpiment and realgar were found in veins. The arsenic ore in some assays yielded $150 to the ton.

In his closing address Prof. Rogers dwelt upon the need of measures calculated to make the meetings of the academy more popular in character. It is not only the province of the academy to aid in research and to facilitate the progress of science, he said; it is also its duty to make its work more generally and popularly known. It is a part of the beneficence of science to extend as widely as possible the knowledge of great truths and of the advances that are made in the discovery of underlying facts and principles.

It is proper to add that in preparing our review of the proceedings of the academy we have been largely aided by the ample reports furnished by the New York *Times*.

ROADMASTERS' DIFFICULTIES.

At the first annual convention of the International Roadmasters' Association, at Niagara Falls, last September, the difficulties experienced in maintaining railway tracks were discussed by the members at great length. The proceedings are reported in full in the *Railroad Gazette*, October 10 and 17.

Mr. Wiswell said that the most difficult thing he had to contend with was sliding clay banks in the spring of the year. He had thought it might be economical to use old sleepers for retaining walls; had heard of bank walls of old ties, on the Central Vermont, which had lasted twenty years and were still in good condition.

Mr Hardy complained of fire and water. The latter occasions all sorts of trouble; sometimes it comes and takes out a culvert or bank; sometimes it soaks into clay banks, and down comes the bank on the track; and sometimes it comes under the track. He thought the New England men would bear him out in saying that with fire on the bridges, and water in the wash-outs and slides, throwing the track in many cases, they could sum up the principal part of their anxiety and trouble

He then asked the opinion of the members as to the relative merits of gravel, stone, and other forms of ballast. Mr. Collopy thought gravel ballast the best of any; better even than furnace cinders, which were liable to break in winter. Locomotive ashes make good ballast The trouble with them, however, is the difficulty and delay of unloading cinders. He had also used rolling mill clinkers—slag, iron, and limestone.

Mr. Sullivan had tried the latter. He objected to cinders because they cause the ties to rot very fast. In locomotive cinders the ties (burr oak and white oak) play out in three or four years. In mill cinders they last as long as with gravel ballast. Touching the life of ties on the Atlantic and Great Western road, Mr. Latimer said that on the first division, where there is nothing but gravel ballast, ten years is the average; including sidings on the second division, which is also gravel ballast, but very poorly ballasted, eight years and four months; on the third, hardly better ballast, nine and one-tenth years; on the fourth, a good deal better ballast, ten years and three months. On a portion of the road, not well ballasted, very poorly ballasted indeed—that is, the third division—seven years and eight months; and in the longest part, better ballasted, eight years and two months. In another portion, where the traffic is light, eight years and five months; and where it is still lighter, with good gravel ballast, eleven years—this with chestnut ties. Mr. Kennedy thought that the more rock was put under a chestnut tie the quicker it would give out.

Mr. Hardy gave the following experience: About three or four years ago there was a piece of track laid for a change, and upon one of those tracks, about three-fourths of a mile, was sawed ties, which wear like bridge ties. He did not think the cutting up of those ties amounted to 25 per cent of the rest of the road. The track is well laid; it is a silicious country, good quartz rock, and there is no heaving. He thought that with a proper rock ballast there must be a great saving in the wear of ties and rails. Mr. Latimer had no doubt that there is more wear upon the rail resting on rock ballast or cinder ballast than there is on gravel, engine cinders, ashes, or coal dust. The ties on hard ballast are more dug into by the rail than on elastic ballast. Mr. Collopy thought there was also more wear on the rolling stock, and more broken rails in winter.

Mr. Armstrong expressed the opinion that locomotive cinders are calculated to preserve the life of some kinds of timber, and are injurious to others. In 1864 he filled a track with locomotive cinders, and used white hemlock ties. Not one per cent of those ties have been removed. He filled another track with cinders, oak ties being used, and they rotted out in five years. He used nine inches of cinders over the ballast.

Mr. Collopy expressed the opinion that the life of a hemlock tie is about three years. Mr. Sullivan said that he put down 5,000 hemlock ties in Northern Michigan, and three years after took them out with shovels. They were too rotten to pull out.

Touching the cost of maintaining a road bed in good condition, Mr. Burnett thought the yearly expense with gravel was about 40 per cent less than with broken rock. The expense of keeping rock ballast free from grass and weeds is about one-half less than with gravel. In regard to keeping a good surface on the road, Mr. Sullivan claimed that rock ballast was better than gravel, the latter being liable to settle unevenly in spring time. His choice would be: first, rock ballast; next, furnace cinders, where they could be got. Mr. Latimer preferred rock with a covering of gravel.

With reference to the heaving of the track by frost and irregular thawing, Mr. Burnett said that under certain conditions the south side of the track may heave as much as the north side. With a clay embankment stone will heave nearly as much as gravel. Stone is more open than gravel, frost penetrates further, and when the clay freezes the track will heave.

Mr. Shanks said that when eighteen or twenty inches of ballast was used there would be little freezing. But if the clay froze to any depth it was absurd to expect it not to heave. Gravel tends to keep the frost out to a certain extent. Mr. Preston suggested that imperfect drainage might be the cause of heaving. Mr. Burnett instanced a cut 250 feet long, the water running eight inches to the bottom of the ties, and there is no heaving. Mr. Wiswell spoke of a rock cut with water right up to the end of the ties, in some places the gravel would be heaved up through the track, but the ties never were out of place. Mr. Hardy's company had a rock cut with much water in it, in which 1,000 feet of new steel rails had been laid. The water gave a great deal of trouble. Mr. Burnett said he would lay 3 inch sewer pipe close to the ends of the ties and fill in with gravel He knew from experience that the method would prevent a great deal of heaving where water came from the top and had no chance to escape from the bottom. Mr. Hardy thought the pipe would not stand the temperature. They had made it a matter of much study, for they had lost a great deal of steel rail there. This on account of the rigidness of the road bed. Owing to the excessive wear in the four months of frost the life of the rails was diminished about forty per cent.

Mr. Adamson's experience was that rock is the cheapest ballast in cuts. The ties last longer, and there is less tendency to heave in winter. Another advantage was the absence of weeds and grass to attract stock. In Indiana good gravel is hard to get. He would prefer gravel if he could get it. It costs less to put in and take out ties in gravel than in rock ballast. The most perfect bed would probably be pure gravel on stone.

THE "CONCH PEARL."

Many of the readers of the SCIENTIFIC AMERICAN have doubtless frequently seen and admired the delicately tinted, pink-faced shells which are extensively used in the United States for bordering garden walks and other ornamental purposes, but few probably are aware that in the conch which forms and inhabits this shell is occasionally found a very lovely gem, known to lapidaries as the conch pearl. When perfect the pearl is either round or egg-shaped and somewhat larger than a pea, of a beautiful rose color, and watered, that is, presenting, when held to the light, the sheeny, wavy appearance of watered silk. It is, however, a very rare circumstance to find a pearl which possesses all the requirements that constitute a perfect gem, and when such does happen, it proves an exceedingly valuable prize to its fortunate finder. A good pearl is very valuable indeed, some having been sold in Nassau for no less a sum than four hundred dollars. Although many of these pearls are annually obtained by the fishermen in the Bahamas, not more than one in twenty proves to be a really good gem, and hence probably their high price.

Pink is the most common and only desirable color, although white, yellow, and brown pearls are occasionally found. Even among the pink ones there is usually some defect which mars their beauty and materially injures them; some are very irregular in shape and covered apparently with knobs or protuberances; others are too small, while many lack the watering, which gives them their great value and chief beauty.

The conch abounds in the waters of the Bahamas, and thousands of them are annually obtained and destroyed for their shells, which form quite an article of commerce, but in not one conch in a thousand is a pearl found. When this is taken into account, and the other fact, that not more than one in twenty of pearls found turns out to be perfect, it will at once be seen that a good conch pearl will always be a rare and costly gem. In fact, their value within the last few years has almost doubled, and the demand for them is steadily increasing.

Most of the conch pearls found in the Bahamas are exported to London, where they are readily sold. A few have been sent to New York, having been purchased in Nassau by an agent of Messrs. Tiffany & Co., the well known jewelers.

Like everything else that is valuable, the conch pearl has been imitated, and some of the imitations have been sold as the genuine article. Many years ago an ingenious American visited Nassau and conceived the idea of making conch pearls. He succeeded admirably in cutting out of the pink portion of the shell some very creditable imitations. To make success doubly sure, he procured a number of the live shell fish, carefully inserted his spurious pearls in the position in which the genuine pearl is usually found, and placed the fish in an inclosed place in the water. At the expiration of a month or more, the fish were again removed, and, of course, pearls found in them, several of which were sold to inexperienced persons before the fraud was detected. It was detected, however, and the perpetrator received prompt and deserved punishment.

SAUNDERS.

Importance of Illustrating Inventions.

Thousands of persons who have spent a little money in bringing their inventions prominently before the public have realized rich harvests thereby. We believe, and have abundance of evidence in support of it, that greater results have been effected to the patentee oftentimes by having his inventions illustrated in the SCIENTIFIC AMERICAN, at the expense of a few dollars, than by thousands spent in injudicious advertising. It is only subjects of merit or novelty that find place in these columns, and to the pages of the SCIENTIFIC AMERICAN, therefore, the public refer for the latest improvements.

Patentees who have good inventions cannot overestimate the importance of having them first illustrated and afterward advertised in these columns. It will usually pay tenfold the cost, and has often paid a hundredfold.

Patentees, and those who wish to have their inventions or machines which they manufacture illustrated in this journal, will receive full information by addressing this office.

James Clerk Maxwell.

The well known Professor of Experimental Physics at Cambridge, England, James Clerk Maxwell, M.D., LL.D., F.R.S., died November 5. Professor Maxwell was an accomplished mathematician and successful investigator in physics. His "Treatise on Electricity and Magnetism," and "Theory of Heat," are his best known works.

A Great Ship enters South Pass.

The British steamship City of Bristol, Inman Line, went through the jetties October 31, drawing 24 feet 7 inches of water. The tide was four inches below the average. There was no detention whatever at the jetties or at the head of the pass. Since that date it has been announced that the largest cargo of cotton ever floated at New Orleans has safely passed outward. Now for the sanitary improvements of the Mississippi Valley, which shall permanently avert the danger of yellow fever blockades.

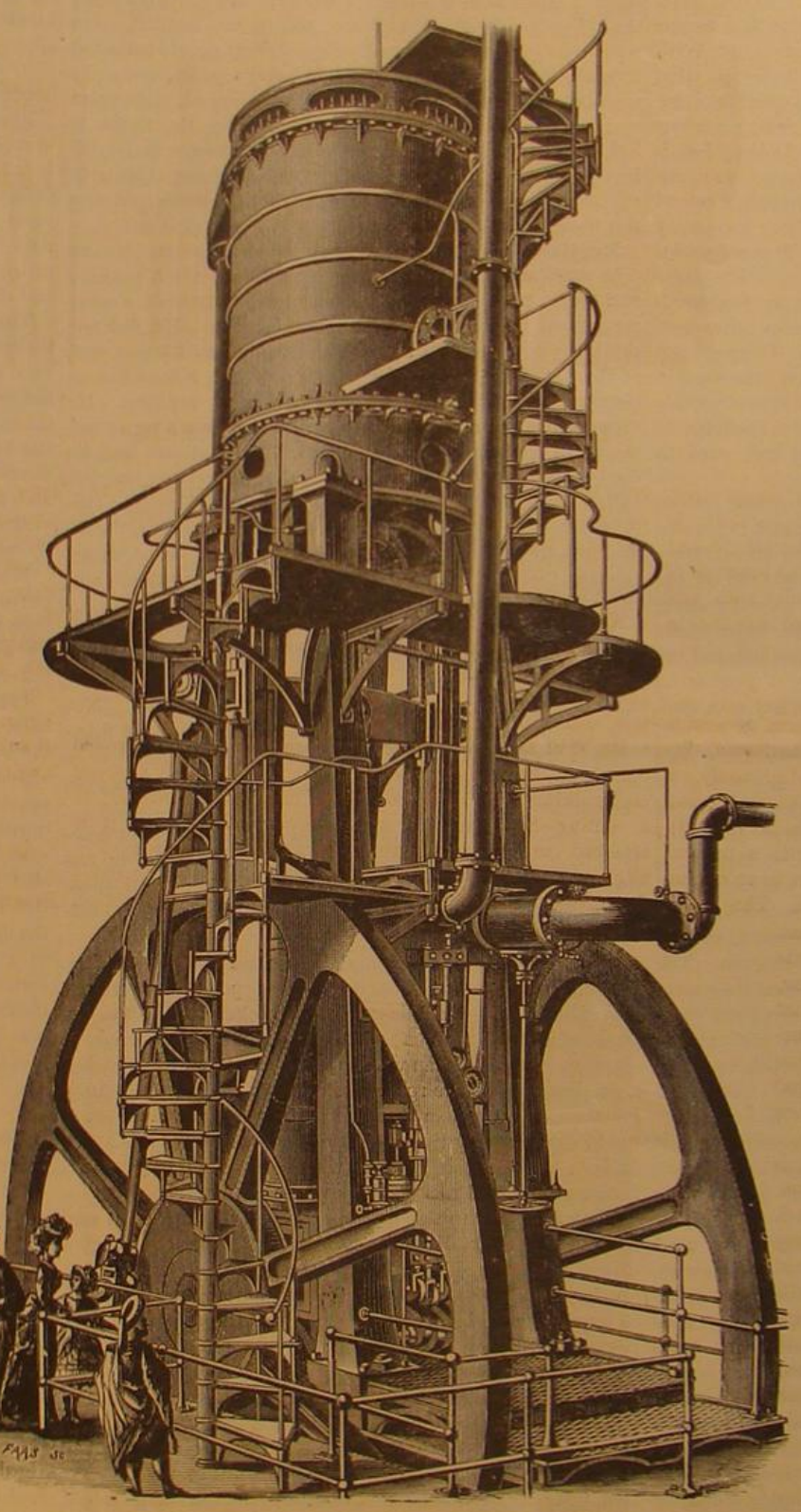
BLAST ENGINE.

The accompanying engraving represents a blast engine made by the I P Morris Company, of Philadelphia. This engine has been designed to meet the wants of American furnace managers, certain requirements having been laid down as a standard which the firm have endeavored to follow as closely as possible. These requirements are: "Completeness without sacrifice of accessibility to the moving parts, self-adjustment of parts liable to irregularities of wear, and steadiness of the whole structure and preservation of alignment by being self-contained." The first engines of this class—a pair having steam cylinders forty inches in diameter, and blast fifty-eight inches, with a stroke of four feet six inches, and producing a blast pressure of twenty-five pounds—were built about ten years ago for Bessemer steel production. Since that time a large number have been built and put into successful operation, showing that the efforts of the builders toward perfection of design have not been without their reward

The firm construct engines on this plan with blast cylinders varying from seventy-five inches in diameter and six feet stroke to one hundred and eight inches in diameter and nine feet stroke, and nearly all of them are provided with condensing apparatus sufficient for initial steam pressure of forty pounds per square inch, admitted during three fourths of the stroke, and producing a vacuum of twenty-four and one half to twenty-six inches.

The engines are fitted with the Wanich equilibrium valve. The essential feature of this valve consists in the use of a ring cast on the back of the main valve, extending upward and bored out so as to envelop and slide freely upon the outside of another ring cast on the steam chest bonnet above, extending downward and turned off evenly on the outer circumference. These rings are of course concentric, and the annular space between them is quite small, very much less than the aggregate area of the holes for the passage of steam below the pilot valve, consequently any steam passing this annular opening when the pilot is raised, goes freely through into the cylinder, exerting no appreciable pressure on the back of the main valve, and permitting it to rise easily. This has been confirmed by connecting an ordinary steam gauge with the space inclosed by the rings, showing the pressure, when the pilot was seated, to be, say, thirty-five pounds, and dropping suddenly almost to zero when the pilot was raised, until the main valve opened, when it rose again to thirty-five pounds. This valve has been in use for about four years with highly satisfactory results, saving steam and proving easily manageable.

The blast valves are of selected thick sole leather, backed with plate iron, and the blast piston is fitted for either metal, wood, or bag backing The steam piston is provided with metal double rings held out by springs. The valves are lifted by cams operating directly against rollers fitted into the bottom ends of the lifting rods, and these cams are adjustable but not variable, giving facilities for experimenting so as to determine the best distribution of steam without interference with each other. The cam shaft is driven by spur gears fitted to the main shaft. The rim of the fly wheels on the side in line with the crank pin is cored out, so that the excess of weight on the other side will counterbalance the weights of piston rods, crossheads, etc. The shaft is of wrought iron, and the crosshead swivels in the yoke connecting the two piston rods, so that it may accommodate itself to any irregularities of wear in the main shaft or crank pins.



I P. MORRIS COMPANY'S BLAST ENGINE.

The engine shown in the engraving has a height of thirty-six and one half feet, weighs two hundred and fourteen thousand seven hundred and ninety-four pounds, and exerts seven hundred and fifty horse power, delivering ten thousand cubic feet of air per minute. The bed plate upon which the whole construction rests is eight feet wide and thirteen feet long, weighs seventeen thousand pounds, and is laid on a foundation of hard brick or good stone at least ten feet in depth, and well anchored to it so as to insure stability. The steam cylinder is fifty inches in diameter, and the blast cylinder ninety inches, the stroke being seven feet. The fly wheels weigh forty thousand pounds each.

The height of the engine is principally due to the length of stroke, and this has been done so that a given quantity of air can be supplied by a less number of revolutions and with fewer beats of the blast valves than is generally adopted in other engines. The direct loss in delivery, due to piston clearance and space in the passage, being a quantity depending on the diameter of the blast cylinder, then if we take a fixed diameter of cylinder it is clear that the percentage of loss of useful effect will diminish as the stroke increases. The engine is provided with a condensing apparatus situated just back of the main working parts, and in the entire construction everything has been carried out with a view to proper economy both in first construction and in future use.

Machinery for Moving Cleopatra's Needle.

Mr Charles Roebling, who designed the machinery to be used in taking down the Obelisk of Alexandria and in setting it up again when it reaches this city, describes it, in the *World*, as a special structure designed to shift the position of obelisks from a vertical to a horizontal position In taking down the monolith the first thing done will be to cover it with a casing of two inch oak planking, which will be bound at intervals of three feet with strong iron bands. This done, the obelisk will be guyed at the top from four points, like the mast of a vessel, so that there will be no possibility of its falling over.

The center of gravity has been calculated to be at a point 26 feet above the base; here will be placed trunnions on either side, which will be bolted across the sides by eight one and three quarters inch iron and four two inch steel bolts. The trunnions are historical in their way. They are cast from cannon metal only, and many of the cannon used were captured from the Confederates during the war, besides which they are the heaviest castings of their kind ever made. The trunnion plates are four inches thick, nine feet wide, and 6 feet high. At the center is the turned trunnion, which is thirty-three inches long and eighteen inches in diameter. The weight of each trunnion and plate is 1,250 lb , making them together 1¼ tons. The metal used in the casting is of the best quality, a sample taken from the same heat having broken at a tensile strength of 2,900 lb. to the square inch. It is seldom that such excellent metal has been obtained.

The next operation will be to quarry out four six inch channel ways through the base of the obelisk and insert I beams, which are to assist in raising it from the foundation.

The foundations for the towers will next be constructed. They will consist of two platforms, one on each side, of three inch oak planking, each six feet wide and twenty-four feet long. On top of these will be set four oak sticks, twelve by eighteen, firmly bolted together. The iron work of the towers will then be built on top of the preliminary foundation. This consists of one wrought iron tower placed on either side of the monolith. Each tower is made of six twelve-inch heavy wrought iron I beams, spreading out at the base to a distance of twenty-one feet and converging at the top to within five feet The beams at their base rest on four heavy I beams, and are securely riveted to the platform by means of plates and knees. Placed on top of these posts are caps, each five feet long and thirty inches wide, which are also secured by means of plates and knees. The posts are braced from top to bottom by angle and channel irons, making the towers perfectly rigid. Placed on top of the caps and securely bolted to the tower proper are cast iron journals which weigh 3,700 lb. each, forming the grooves for the trunnions to work in. A six inch rib is cast on the bottom of each of the trunnions, and in these ribs there are four two inch holes. Through each of these holes one and three-fourths inch iron rods are inserted, connecting with similar rods from the six inch I beams running through the base by means of right and left thread turn buckles, which will be used to raise the obelisk from its foundation and throw the weight on the trunnions. The foundation will then be removed and the obelisk will be left hanging free.

On account of the stone having an unknown factor of safety when supported at its center of gravity or at either end (according to some authorities as low as one and one half times), it has been deemed advisable to strengthen the stone by means of one and three-fourths inch (diameter) wire rope stays, which are run over a frame nine feet high resting on the trunnion, which is intended to be uppermost when the stone is in a horizontal position, to either end of the obelisk. The stays will relieve each end by some twenty-five tons, thus preventing any possibility of the stone cracking at its center of gravity. Having taken every precaution and got the obelisk into a free position it can then be easily turned. This will be a matter of very little exertion, provided the structure is *perfectly aligned.*

When the obelisk is placed in a horizontal position, Captain Gorringe, who is to have the work in charge, will next proceed to build two piles of beams placed crosswise. As soon as they reach the height of the stone jacks will be used to lift the latter out of its trunnion bearings and block it up. All the construction will then be taken away, and foot by foot the obelisk will be lowered to the ground by reducing the piles, first from one side and then from the other.

Once on the ground the obelisk will be incased in an iron cradle, which consists of a parabolic truss on each side, connected by means of heavy channel floor beams and braces. To the floor beams two heavy channel bars will be riveted, and corresponding channels will be laid on the ground to form the train for the obelisk to move on, which will be accomplished by inserting eight inch cannon balls into the grooves formed by the channel bars. The track will be laid sixty feet ahead of the cradles, so that as the stone is pushed along, the track behind will be taken up and placed in the front.

The machinery above described has been made at the works of John Roebling Sons, Trenton, N. J. The castings of the iron work were made by the Phœnix Iron Works Company, of Trenton, and the carpentering work will be done abroad. The description of the obelisk as used by Mr. Roebling to make his calculation is as follows: 67 feet 2 inches high, 8 feet 2½ inches by 7 feet 9¾ inches wide at base, 5 feet 2 inches by 5 feet wide at top. Substance, granite; center of gravity distant from base, 26 feet; surrounding (character of) soil, sand.

The same structure, with very little difference in the manipulation, will be used to erect the obelisk when it is brought to New York.

Electrical Camphor.

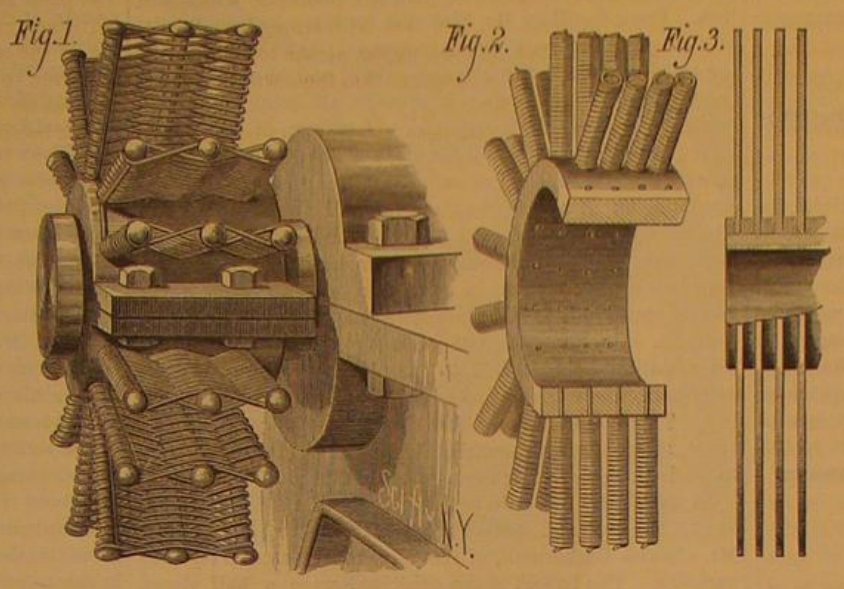
If a small bit of camphor is laid upon water it begins turning and moving about with great rapidity. If a few grains of lycopodium or other light powder have been previously scattered on the water they are drawn toward the camphor by eddies in an inverse direction. These phenomena were observed in 1748 by Romieu, who attributed them to a difference of electricity between the water and the camphor. Subsequent investigators thought they might be due to the camphor vapor striking the water and producing a recoil. M.

Casamajor has, says *Les Mondes*, resumed the study of the question and adopted the views of Romieu. He instances the following crucial experiment: At the same time that the bits of camphor are thrown upon the water insert a glass rod which has been rubbed with flannel; the motion immediately stops. If the electricity is removed from the rod by rubbing it with tinfoil, it loses its power of checking the eddies.

A NEW DEVICE FOR PREVENTING JOURNALS FROM HEATING.

It frequently happens that in spite of any amount of precaution the journals of machinery will heat and cause trouble and delay and work injury to the bearings. In many cases the difficulty may be overcome by the reconstruction of the entire machine, but this is expensive and inconvenient. The invention of Mr. James Dempsey, of Lewiston, Me., which is shown in the annexed engraving, is intended to obviate this difficulty by conducting away and dissipating the heat by means of metallic conductors, exposing a large surface to the air. Three forms of the device, all based on the same principle, are shown in the engraving. That shown in Fig. 1 consists of a copper collar fitted closely to the shaft near the bearing, and provided with a number of radial pins, around which copper wire is wound or woven so as to present a large radiating surface to the surrounding air. The temperature of the shaft can never greatly exceed that of the collar clamped upon it, and the temperature of the collar cannot become much higher than the air in which the pins and surrounding wires revolve.

In the form shown in Fig. 2, spiral copper wires are inserted in the collar to conduct away and dissipate the heat; and in the form shown in Fig. 3, metallic disks are employed as radiators instead of wires. There are, in fact, many forms in which the device may be constructed, and, as will be necessary, modify the apparatus for different applications, the inventor does not limit himself to any particular form. The device is applicable to the bearings of shafting, to car axles, to the shafts of calender rolls, and other journals liable to heating. The inventor says that in actual use it has proved very efficient.



DEMPSEY'S COOLER FOR JOURNALS.

NOVEL STEAM GENERATOR.

We give herewith an engraving of a steam generator recently patented by Mr. Charles Ward, of Charleston, W. Va., and lately tested both as to efficiency and economy on the experimental stern-wheel steamer Wild Goose, plying on the Kanawha river. We understand that the boiler easily evaporates 85 cubic feet of water per hour, with a natural draught, and supplies steam at 190 lb. pressure to an engine having a 9¾ inch cylinder and 3 foot stroke. The boiler occupies a space 7x8 feet on the deck of the boat, is 8 feet high, and has 28 square feet of grate surface; the smoke stack is 30 inches in diameter, and the weight of the boiler is only one-fourth that of flue boilers of the same capacity. Its construction is such that a perfect and rapid circulation of water is secured. The inventor claims that the effect secured in rotating boilers is secured in this without mechanical contrivances.

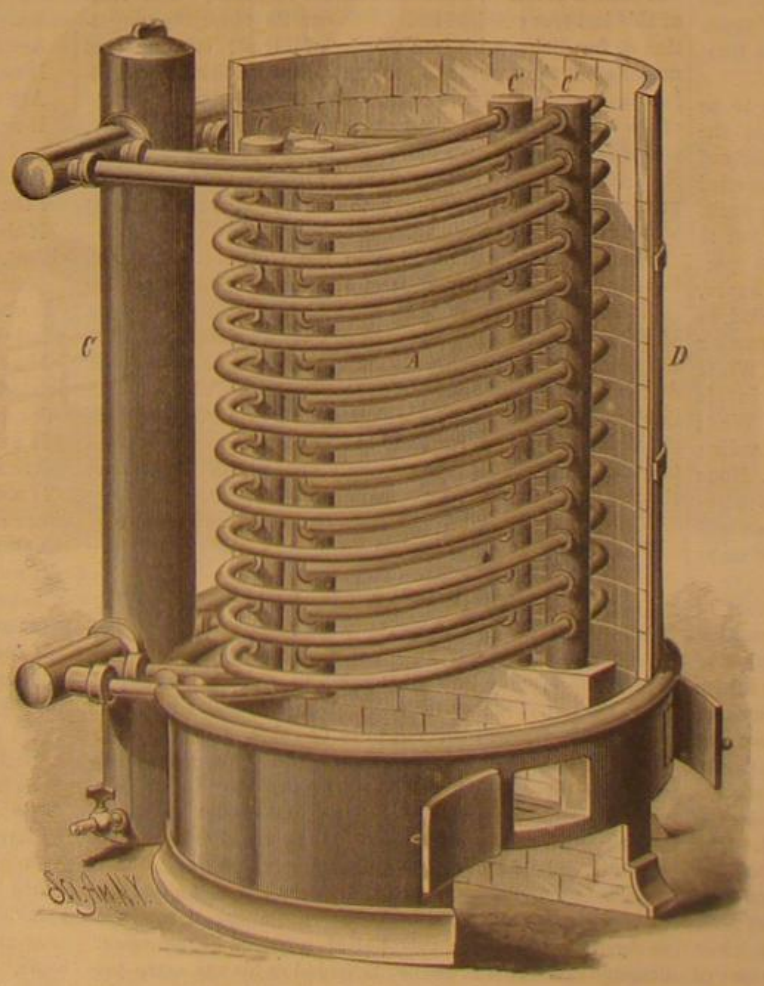
The Wild Goose is running daily, and is considered a perfect success by her projectors. The boiler has been twice inspected by the U. S. Steamboat Inspectors, and is allowed to carry 193 lb. per square inch. The boiler consists of 4 piles of 20 circular 2-inch iron tubes, the coils having respectively a diameter of 2, 3, 4, and 5 feet, all having perfect connection with each other, and by their arrangement securing compactness, lightness, a maximum of heating surface with a minimum of fuel, and practically absolute freedom from danger of explosion.

Our engraving represents a boiler having only two sets of curved tubes instead of four, but otherwise the same as that used on the Wild Goose. The connected series of curved pipes, A, are concentrically arranged and are inclosed by a concentric iron casing, D, having a firebrick lining. The inner series of pipes surrounds a vertical cylinder having a firebrick facing. The curved tubes are inclined and connected with vertical stand pipes, *c c'*, which are located on opposite sides of the boiler in line with the division wall of the fire box. The curved pipes are inclined, to facilitate the flow of water and steam toward the upper end of the stand pipes.

The flame and products of combustion pass up from each portion of the fire box in the spaces between the pipes, and between the pipes and the outer casing and the central cylinder. These firebrick surfaces reflect the heat upon the curved tubes, and this, together with the direct action of the flame and heat from the fire, insures the rapid generation of steam. The steam and water are separated by the cylinder, C, which is connected at its upper end with the upper ends of the stand pipes, *c'*, and at its lower end with the lower ends of the stand pipes, *c*. As the steam and water enter the cylinder, C, through the upper connecting pipes, the water falls while the steam is taken to the engine. A perforated diaphragm is placed across the cylinder just above the upper connecting pipes and below the engine supply pipe, to prevent the water from following the steam.

The water that falls in the cylinder returns to the boiler through the lower connecting pipes.

The stern-wheel steamer Wild Goose, upon which Mr. Ward's boiler is used, is said to be the lightest and fastest boat of its class ever built. It is 110 feet long, 16 feet beam, and 3 feet depth of hold, and draws but 16 inches. The wheel is 13 feet in diameter and 10 feet 6 inches wide. The boat has made 10 miles in 45 minutes, with a current of two miles, and it is claimed that it has no equal in stemming the chutes or rapids on shallow rivers.



WARD'S STEAM GENERATOR.

AGRICULTURAL INVENTIONS.

Mr. Moses N. Ward, of Cedar Rapids, Iowa, has patented a simple but efficient arrangement for operating the dasher of the churn. The invention consists in a short slotted lever and a long vibratory lever connected by a screw in combination with a shaft and dasher.

Mr. Will Adair, of Canmer, Ky., has patented an improved cotton and hay press for baling cotton, hay, etc., or pressing and packing other commodities. The platen is attached to a sliding beam, and the mechanism for actuating it is attached to another sliding beam, which is arranged in alignment with the platen beam, and is allowed to move downward alternately with the platen. The mechanism consists of a train of gears and an involute wheel or eccentric, which is operated thereby, and acts intermittently on the head of the platen beam or stem to force the follower downward.

Hose Pipes.

In a little pamphlet entitled "Fire Hose," the writer of which is an Englishman, and also evidently a firm believer in leather hose, we find the following:

"The history of flexible fire hose is not a long one. Its invention is claimed by two Dutchmen, both named Jan Van der Heide, who were inspectors of fire apparatus in the principal city of their country. In the year 1672 it was first publicly tried, and was found to be so successful that, within a twelvemonth, the old engines were discarded, and were replaced by new ones to work with flexible suction and delivery hoses. Five years later the Van der Heides were granted an exclusive privilege, which secured to them the right to manufacture these hoses for a period of 25 years. This hose was made in 50 foot lengths, and was coupled by brass connecting screws. We find also that at this time, besides the leather hose, pipe of sailcloth or canvas was manufactured, and that 'a seamless fabric, covered with cement or paint, was used.' Here, then, we have the canvas and woven hose which has lately been brought forward as a new invention. The reason of this is to be found in the fact that canvas hose rapidly gave way before its rival, leather, which, although it was by no means perfect, being 'sewn together like a boot leg,' and far from water tight, yet, to the mind of our forefathers, was evidently the superior of the two. It was not till 1760, eighty years after the invention, that flexible hose was introduced into this country. In 1808 copper-riveted leather hose was first made by Messrs. Sellers & Pennock, of Philadelphia; thus the honor of so great an improvement in such a valuable article belongs to an American house. Eleven years later Mr. Jacob Perkins introduced copper-riveted hose into Great Britain, and at the same time brought into use an improved coupling, which connected the hose without twisting it or diminishing the water-way, for which he was awarded a silver medal by the Society of Arts. Hempen hose, woven without seam, was made in Leipsic by one Beck, a lace weaver, in the year 1720. After this it was made by Erke, a linen weaver at Weimar; and at a later period of linen at Dresden, and also at Silesia. The canvas hose, recently introduced and flaunted before the public as something new, has been tried and abandoned 150 years ago. India rubber hose was brought out about the year 1827, by Mr. Thomas Hancock, of Fulham, and is thus the latest invented of any of the principal descriptions of hose that are in extensive use."

MECHANICAL INVENTIONS.

An improvement in plates for holding screw-cutting dies has been patented by Mr. Johan G. Geiser, of Fort Clark, Brackettville, Texas. This invention relates to hand plates for holding screw-cutting taps and dies. It consists in certain novel features by which screw threads may be more conveniently cut than heretofore, and whereby left hand taps may be formed from blanks by right hand screw-cutting devices.

Mr. Aaron T. Hammer, of Sedan, Kan., has patented an improved sewing machine motor, which consists in the combination of devices by which the vertical motion of a platform is converted into rotary motion and transmitted to the band wheel when the platform moves down.

An improvement in dumping wagons has been patented by Miss Annie McFarlane, of San Bernardino, Cal. The object of the invention is to provide a cheap, simple, and convenient dumping cart or barrow that will be especially serviceable in mines.

Mr. Benjamin F. Walters, of Norfolk, Va., has invented an improved machine for removing the stems, particles of dirt, and other adhering impurities from peanuts, and for polishing and assorting them for the market; and it consists in a peculiar arrangement of a polishing brush, and in means for rendering a picking apron detachable from the discharge end of the separator.

Mr. Daniel M. Holmes, of Arlington, N. J., has invented an improvement in the construction of the cake machines for which letters patent, Nos. 174,244 and 188,366, were granted, February 29, 1876, and March 13, 1877, respectively, to the same inventor. The object of this invention is to make the machines more convenient in use and more reliable and effective in operation.

Mr. Jackson M. Rose, of Abingdon, Va., has patented an improvement in the class of beds or bodies of farm wagons which are made in sections to adapt them for extension longitudinally.

Mr. Frank W. Devine, of Carrollton, Mo., has patented an improved chain pump and curb, which consists in constructing the curb or casing above the ground in a portable shape, and in combining the suspended chain with a pipe or tube terminating at one end in a discharge spout and at the other end in a bent neck having a funnel-shaped mouth, the bend being made larger than

the other portion of the pipe and provided wtih an opening for admitting the water.

Mr Joseph Baker, of Lebanon, O., has invented an implement for cutting the wire bands with which sheaves of grain are bound. It consists of a blade with a hook at one end, and at the other a stock and bent lever connecting with one end of a rod on top of the blade, the other end of which has a right angular forked projection fitting over the blade, to which it is connected by pivots working in V-shaped slots in the fork. On one side of the fork is a cutting bit, and on the other a clamping edge opposite a lug attached to the end of the blade. The wire being caught by the open hook, the forked projection is thrown forward, severing the wire, one end of which is caught between the clamping edge and the lug, and thus drawn from the sheaf.

Correspondence.

Protection from Lightning.—A Note from Professor Macomber.

To the Editor of the Scientific American:

Your criticism of my use of the word "practical" in the SCIENTIFIC AMERICAN of November 1, is, to a certain extent, proper. In the amount of space accorded me for reply to a correspondent it was impossible to consider the matter fully. Fearing, however, that your criticism may lead readers to deem me an advocate of the "Chambers" lightning rod, I desire to call your attention to the fact that I have denounced that rod in language which cannot be mistaken, and the company has actually commenced a suit against me for $50,000 damages in the United States Court of this State. J. K. MACOMBER.

Phys. Laboratory, Iowa Agricultural College,
Ames, Iowa, October 27, 1879.

Iron as a Fertilizer for Pear Trees.

To the Editor of the Scientific American:

It is conjectured that New Haven County, State of Connecticut, has a larger supply of choice pear trees than any other county in the United States. In the city of New Haven alone, their number increases to thousands. As the city is renowned for its noble elms and unsurpassed shade, likewise is it noted for its neat cottages and fine residences, about which are yards and gardens abounding with ornamental and fruitful vines and trees. Every owner of a lot seems to have devoted a portion to the culture of fruit. Of the large variety represented, the pear tree and grapevine are the most prominent. One gentleman has over two hundred varieties of pears growing on two separate plots of ground, embracing hardly more than 300 feet square. This number may appear to the owner of a single variety like a marvelous amount, but when placed in connection with the multitudinous number in existence, it dwindles through the comparison. It is stated that the celebrated pomologist of Europe, Dr. Van Mons, has fruited over eighty thousand varieties, which is only a small portion of the whole number produced by different individuals. This may seem incredible to those who are not acquainted with the culture of this fruit; and to those familiar with the peculiarities and capricious nature of the pear, it becomes a matter of no little surprise.

The climate as well as soil of New Haven appears to be peculiarly adapted to the culture of pears; but when the soil is examined closely it is found to be composed mainly of sand with a small proportion of iron, which is a needed requisite for stimulating the growth of the tree and fruit. When we take this fact into consideration, we are led to expressions of surprise at the success met with in this particular branch of pomology. There are bounds, however, to the successful culture of pears, as varieties have failed, in nearly all instances, of proving profitable. Of this number the most prominent is the Flemish Beauty and White D'Oycne. The latter, however, is now hardly known in this section, although it flourishes well, it is said, in the West; while the former, on account of the poor success attending the ripening of its fruit, is looked upon with disfavor. None were able to give any cause for this failure, and it was therefore with no very great hopes of ascertaining the cause and finding a remedy that I early in the season commenced making this variety something of a study.

In pursuing the study I have considered the manner of cultivation and nature of the fertilizers used, also position of the trees, and have selected three or four upon which to remark. The first to be mentioned is a standard, some fifteen feet in height and between twenty-five and thirty years of age, growing near a farmhouse a short distance from the city. The tree is sheltered upon the west, north, and south, but not upon the east. The ground is turfed and receives no fertilizer. This tree blossomed and set full, but the pears commenced early to crack, and none ripened. The second tree is a dwarf, notwithstanding the nature of the Flemish Beauty is a standard, growing in the western portion of the city. It is some twenty years old and not over ten feet high. It stands within eight feet of a high close board fence, and about it on the other sides stand trees of different varieties that produce excellent fruit. The ground about the tree is cultivated and fertilized from a compost heap. The tree blossomed full last spring, and the indications were promising for a superior crop until the pear had reached the size of an average Sickle, when they commenced cracking. At that time there was a sufficient quantity on the tree, had they matured, to make about two bushels of pears, but in place of gathering that amount but one ripe Flemish Beauty was plucked from the tree. All of the others had cracked, a very few had prematurely ripened and dropped off, in all furnishing not a dozen good ripe pears.

The third tree is one belonging to Henry Hale (Henry Hale & Co., carriage builders), and growing near Mr Hale's house, situated in the lower or eastern portion of the city. The tree is a standard of a very thrifty growth, about twenty five years old, and as many feet in height It is protected on the south by his dwelling, the north by standards of different variety and the carriage factory; east and west by adjoining gardens. The ground is turfed save a circle about four feet in diameter around the tree. Within this space the earth is kept loose and free from weeds or other vegetation. For a fertilizer Mr Hale has for many years used one of a peculiar nature, it being composed of the sweepings of the smith shop and the shavings, dust, and dirt from the room in which the woodwork is made, all being burned in one heap, and the residue used as a fertilizer, it being well mixed with the earth about the trees The sweepings of the smith shop is comprised of many particles of iron varying in size from an iron filing to that of a half ounce in weight. The trees treated in this manner, and the Flemish Beauty in particular, are remarkable for their healthy appearance This tree produces pears of great and unusual size, which mature well, and, as Mr. Hale states, have never been known to crack. His knowledge of cracked pears was acquired by his attention being called to samples shown him by his neighbors, who were unsuccessful in raising Flemish Beauties. This season the tree bore the extraordinary crop of between six and seven bushels, the largest weighing from ten to twelve ounces, a fair average being nine ounces.

At the county fair held in this city there was a collection of two hundred and seventy-five plates, of which number Mr. Charles Dickerman, of this city, represented sixty-four varieties. The largest pears exhibited were a half dozen Napoleons; next came the Dutchess. The Flemish Beauty was represented by only three or four plates, of which Mr. Hale took the first premium; the nearest approaching his in size being very much smaller.

The conclusion I have reached regarding the cause of failure in crops of Flemish Beauty is to attribute it to the lack of iron in the soil. This is based upon the success met with by Mr. Hale in the culture of his trees, representing quite a variety, all of which excel in size and quantity of fruit. It cannot be ascribed to the virtue of the ashes, as the residue from each burning remains as an accumulation to the pile, gradually increasing its size for several months before a sufficient quantity to warrant its removal has been heaped together. The ashes are meantime leached by rains, and their strength is exhausted. The particles of iron do not so readily waste their strength, but when corroding enter into the ashes, enriching them with its changed form and becoming a suitable ingredient for nourishing the roots and trees. This conclusion is strengthened by considering, in connection with this tree, one growing upon the opposite side of the street from Mr. Hale's ground. It has the advantage of the same soil and similar location, but not the same fertilizer. The fruit of this last tree cracked badly. Is not therefore the suggestion of fertilizing with iron worthy of a trial? It would cost nothing but the trouble to procure some iron filings or drillings and occasionally mix them with the soil about the roots of the tree. Filings or drillings corrode the most readily, and would prove the speediest manner of producing the desired effect. One year's trial may produce no decided improvement; several may prove no better; yet we consider it worthy of a trial.

There is another indication in the fruit of the Flemish Beauty of an unhealthy state of the tree, consisting in the pears becoming covered with small black spots; and a lack of vitality by the leaves turning and falling early. Neither the spots nor blotches are found upon Mr. Hale's fruit, nor do the leaves prematurely fall from the tree. The fruit on this tree is possessed with a dark green skin, marked with streaks or blotches of rust, and in ripening the green changes to yellow, the rust is more strongly defined, and the scarlet tint, so much admired by pomologists, deepens.

GEORGE A. HUBBARD.

New Haven, Conn., October, 1879.

The Blake Transmitter.

To the Editor of the Scientific American:

It is somewhat remarkable that the friends and admirers of Mr. Edison take such great pains to prove to the world that he is the inventor of every electrical instrument and contrivance which turns out to be of value.

Not satisfied with the signal defeat which Mr. Edison sustained in the great microphone controversy in Europe, where the leading scientists, without exception, supported the claim of Professor Hughes, that the microphonic action is totally different from the principle which Mr. Edison has always claimed as the basis of his carbon telephone, viz., "the property possessed by some substances of moderate conductivity of having this power modified by pressure," although even this cannot be regarded as his exclusive property, as it was discovered as early as 1856 by the Count Du Moncel, and described by him in his "Exposé des Applications de l'Electricité," and also used by M. Clerac in 1865—not satisfied with this, I repeat, an attempt is now made to induce the public to believe that Mr. Edison is also the inventor of the only really successful microphonic transmitter ever produced. I allude to that invented by Mr. Francis Blake, of Newton Lower Falls, Mass., and described in your issue under the date of November 1.

Wherein the similarity between the Blake and the Edison transmitters lies, it is difficult for one acquainted with both to say, save in the fact that both are used in combination with an induction coil, the secondary circuit of which is a part of the main line.

I have examined Mr. Prescott's account of Mr. Edison's inertia telephone, and find it totally different, both in action and principle, from any microphone.

It appears, however, from the article in question that Mr. Edison's latest transmitter, described also in the SCIENTIFIC AMERICAN a few weeks since, is also like the "old invention," in principle. If so, it is a query why the Western Union Company did not bring out this superior instrument instead of the carbon telephone, when the latter was beaten everywhere by the Blake transmitter. The fact really is that the Western Union tried to imitate the Blake transmitter at different times since its introduction, a year since, and could never make the imitations work, simply because the Blake transmitter has a few technical points on which its success depends, and which are only known to the electricians of the National Bell Telephone Company.

Mr. Prescott states in his book, and it is found to be true in practice, that although many substances may be used as a conducting medium for varying resistances in the Edison transmitter, lampblack is the best; per contra, lampblack is not used in the Blake transmitter at all, the substance used being invariably very hard gas carbon, besides which Mr. Edison himself states in his patent 203,016, that unmixed carbon is not adapted for use in his transmitter.

The article we have alluded to as in your last issue, in its second paragraph states that there is "nothing delicate or fine about the construction" of the Blake transmitter. In the third paragraph we find the words, "this casting supports two delicate springs, etc." One of the main features in this transmitter is the delicacy of the adjustment obtained by means of the casting, which is perpendicularly across the inside of the diaphragm, and the screw in its lower end. In conclusion, I desire to say that no caviling spirit dictates these remarks, but simply a desire for justice to the Blake transmitter, its inventor, and perfecters.

Boston, October 29, 1879. T. D. LOCKWOOD.

A String of Questions.

To the Editor of the Scientific American:

Please allow me a small space in your scientific journal (which assists to educate scientists as well as the mass of your readers) to propound a few questions for philosophical thinkers to elucidate and explain.

Is there such a thing as a vacuum in a molecule of matter?

If not, is there such a thing as a vacuum anywhere outside of a molecule of matter?

If not, where is the capacity of matter for elasticity?

If there are no vacuums, or no room for movement of molecules, how do they manage to change places?

If there are vacuums (which I claim) are they not necessarily perfect vacuums, either inside or outside of molecules?

Are molecules invariably spherical in form?

If so, what occupies the interstices?

Are molecules all of the same size?

If so, how do you account for the angularity of crystallizations?

If not of the same size and density, how do you account for the even flow of electricity along a good conductor?

If they are irregular in size, shape, and density (which I claim), can the phenomena exhibited in their movements be explained on any other ground than that there are perfect vacuums either inside or outside their organism.

Is heat or caloric a principle or a result?

If not a tangibility, can its phenomena of action be explained on any other ground than a result of activity of molecules by friction?

Is not the result of friction electricity?

Are not heat and electricity identical?

If not, explain the different results of the excitation of either as molecules of electricity or molecules of matter in the abstract?

If a cake of Northern lake ice will thaw or melt a portion of polar ice, by the activity of molecules adjusting the temperature, is the result heat or electrical activity?

If the force of heat or electrical activity can be measured, why does combustion produce such unequal results by same quantity in each different substance?

H. S. B.

A Small Steamboat.

To the Editor of the Scientific American:

I have been interested in several descriptions you have given of small steam yachts, and as I have lately built one which is (with one exception perhaps) the smallest recorded, I thought you might like to know of it, as there is now a general interest in the subject of small cheap steam pleasure boats. You will notice the results I get with a very small engine by having a light boat and high pressure.

The total length of boat is 15¼ feet; beam, 4¼ feet; depth 22 inches; built of ⅛ inch cedar, lap joint on ¾x1¼ oak ribs, and sheathed inside. Total weight with flagpoles, awning, etc., about 400 pounds (without boiler, etc.).

The boiler is made of a piece of lap-welded boiler flue, and is 12 inches diameter and 34 inches high (upright), with 40

¾" seamless brass tubes, and is provided with steam and water gauges, whistle, etc. Engine is upright, with reverse link motion, having a cylinder 2 *inch bore by* 3 *inch stroke;* runs at about 200 per minute, under a pressure of 100 pounds in boiler. Propeller is 16 inches, 3 blades on a 1 in. shaft, coupled to engine with universal joint. The pump takes water from outside or the bilge box, and will throw into boiler or over side of boat. Total weight of boiler, engine and shaft, wheel, etc., 400 pounds. About three scuttles of coal are used in 10 hours' steaming. On still water I get a speed of 5 to 6 miles an hour, or with the tide about 8. The total cost of the boat was less than $230, including machinery, etc.

Yours very truly, FRED. F. SMITH.

Bridgeton, N. J., October.

Curious Facts Concerning the Cochineal Insect in the Canary Islands.

To the Editor of the Scientific American:

It is well known that these islands are the great producing market for the insect dye cochineal, giving perhaps seven-eighths of the earth's product. Therefore it naturally falls under one's notice both in its cultivation and its preparation for market. The birth is brought about by placing the madres (mothers) in a kind of hot house, and spreading them out thinly on shallow wooden boxes. The insect, as it thus appears, may be likened to a grain of wheat just taken from a pool of dirty water, as it is about that size and shape, but of a dark lead color. It has neither head, legs, nor arms, and shows no signs of life. Yet after being in the warm room a short time they begin to give forth their young.

These, to the inexperienced eye, seem to be little white specks, as devoid of life as the mother. On close examination, however, they are found to be endowed with life and activity, and have their head and arms or legs as well formed and distinct as other insects.

The mother continues to give birth for some days. Some insects are said to give as many as 800 young ones, but they invariably die when they have brought forth their progeny.

The young ones are taken to the cactus plant (which is at once their home and their sustenance) on cotton cloths, to which they adhere when the cloths are spread over the shallow boxes. These cloths are sometimes covered in a few moments, so rapidly does the parent give birth, and some one has to be with them constantly for removing the full cloths and replacing fresh ones. The cloths seem to be covered with a white powder, but the cochineal grower knows that they are the basis of his yearly earnings, and has them sent out at once to the cactus, to which the cloths are fastened by a small thorn which grows on the same plant.

Once attached to the plant the insect forsakes the cloth, and adheres to (or burrows slightly in) the plant. It soon becomes stationary, begins to grow, and assumes the characteristics of its parent, that is, loses all signs of animation, drops all its members, and becomes a part and parcel, as one may say, of the plant.

It seems to "shuffle off its mortal coil," and appears as inert and inanimate as the cactus. Notwithstanding this apparent lifelessness, they are as sensible to heat and cold as other insects. Every year the proprietor suffers more or less loss from the extreme heat sometimes felt here. This heat comes from the great Sahara Desert, and causes death to the insects by asphyxia. Early in July there were a few days of this weather, which, it is said, destroyed at least one third of the crop. I can readily believe this, as the insects had just been "planted," or put upon the cactus; and the younger they are the more sensitive they seem to these changes of the weather. They are, however, liable to loss this way as long as 30 or 40 days after being placed on the plant, and when near to maturity.

The heat kills or stops growth, the insect dies, and drops from the cactus on receiving the slightest touch of wind or other weather. The most remarkable point concerning this specimen of the animal world is, that the foregoing *only refers to the females*, as the male is a creature entirely distinct in its form and habits and mode of life.

The males are very scarce in comparison with the number of females, some assert in the proportion of one to one hundred thousand. The male has wings and flies from plant to plant, with a body like an ant. These visits from plant to plant give for their result the operation I described at the beginning of this article, that is, the hatching of the young insect.

Now the scientific questions that arise in my mind are:

1. What kind of life is this of the female, after being placed on the plant? Is it a semi-animal, semi-vegetable life?

2. Is there any other example in nature where the proportion of the female in numbers is so much greater than the male, and where their form, habits, and life are so distinct?

3. Is there any other insect that gives direct from the body (without eggs) such great numbers of young?

Santa Cruz de Teneriffe, Canary Islands, Oct., 1879. H. B. M.

ANY fibrous material can be stuck to metal, whether iron or other metal, by an amalgam composed of good glue dissolved in hot vinegar with one third of its volume of white pine pitch, also hot. This composition, it is said, will give a sure and certain result.

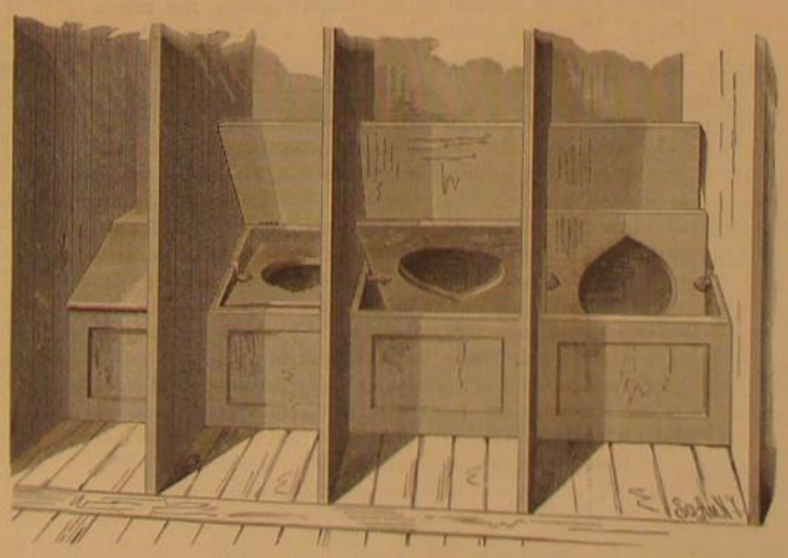
HOW TO WORK THE NEW COPYING PROCESS.

This process consists in transferring to a pad or tablet, composed essentially of a gelatinized solution of glue in glycerine, writings made on paper with a strong solution of one of the aniline dyes—violet or blue being generally preferred—and from this obtaining duplicate copies of the original by simply pressing sheets of paper on the transfer. The *modus operandi* of the copying is given briefly as follows:

Write with a steel pen on ordinary writing paper; allow to dry; press the writing gently upon the tablet, allow it to remain a minute, when the greater part of the ink will have been transferred to the gelatinous surface, and as soon as the paper has been removed the tablet is ready to take impressions from. Place ordinary writing paper upon the charged tablet, smoothing over with the hand, and immediately remove the sheet, which will be found to bear a correct copy of the original writing; repeat with other sheets until the transferred ink becomes exhausted. Immediately after, wash the tablet with water and a sponge, let it dry, and it is ready again for use.

NEW COPYING PAD.

With a tablet and ink prepared according to the following fifty good copies from one transfer have been obtained, and doubtless with care it would afford twice this number. The proportions for the pad or tablet are: Gelatine, 1 ounce; glycerine, 6¼ fluid ounces. Cooper's gelatine and pure concentrated glycerine answer very well. Soak the gelatine over night in cold water, and in the morning pour off the water and add the swelled gelatine to the glycerine heated to to about 200° Fah. over a salt-water bath. Continue the heating for several hours to expel as much of the water as possible, then pour the clear solution into a shallow pan or on a piece of cardboard placed on a level table and having its edge turned up about ⅛ inch all around to retain the mixture, and let it remain for six hours or more, protected from dust. Rub over the surface a sponge slightly moistened with water, and let it nearly dry before making the first transfer. The ink is prepared by dissolving 1 ounce of aniline violet or blue (2 R B to 3 B) in 7 fluid ounces of hot water, and, on cooling, adding 1 ounce of wine spirit with ¼ ounce of glycerine, a few drops of ether, and a drop of carbolic acid. Keep the ink in a well stoppered bottle.



PARK'S IMPROVED CABINET SEAT.

IMPROVED CABINET SEAT.

The accompanying engraving represents an improved privy seat recently patented by Mr. Edwin R. Parks, of Copper Falls Mine, Mich., and intended more particularly for school privies and those of passenger depots, railway cars, boats, hotels, and other public places.

The invention consists in a seat made alike on both sides, and pivoted at opposite edges, so that it may be turned over or reversed. The engraving shows the seat in several positions, so that its construction may be readily understood without further description.

MISCELLANEOUS INVENTIONS.

Mr. Henry R. Robbins, of Baltimore, Md., has invented an improvement in fare boxes for street cars. It consists of an inclined conduit arranged between the back of the seat and the side of the car, and having depositing throats of different lengths extending upwardly from it between the windows, the conduit having a receiving box at its lower end, where it may be inspected by the driver.

Mr. William H. Russell, of Sedalia, Mo., has patented an improved vapor burner designed for burning gasoline and other light hydrocarbons for illuminating and heating purposes. The characteristic features of this invention are a double set of horizontal curved deflecting plates, a rotary cut-off located between the two sets of plates, and opening and closing communication with an internal tube, and a surmounting generator or globular chamber located above the plates in the flame space.

An improvement in dies for forming metallic horse collar frames has been patented by Mr. Ebenezer Fisher, of Kincardine, Ontario, Canada. This invention relates to an improvement in the dies for forming metal plates into the shape required to adapt them to form the sides of a horse collar; also to an improved metal collar or collar frame, the product of the dies.

In putting up pills which are prepared with an adhesive substance or composed of deliquescent material, it has been customary to place in the box with the same a dry harmless powder of some kind, which prevents the pills from sticking to each other or to the sides of the box. This powder frequently cakes in the bottom of the box, and always in removing a pill it is impossible to avoid taking up some of the powder with the pill. Mr. Norman V. Randolph, of Richmond, Va., has patented a device designed to avoid these objections. It consists in a box with a perforated diaphragm which divides the box into two compartments, into one of which the pills are inserted, and into the other the powder may be shaken and separated from the pills when they are to be handled or removed.

Mr. Theodore L. Wiswell, of Olathe, Kan., has patented an improved harness buckle, to which straps can be conveniently and securely attached without doubling or looping and sewing in the usual way. The buckle is composed of an apertured plate, a loop and tongue. The looped ends of the apertured plate are turned outward, so that the strap may be readily inserted in the buckle.

An improved faucet has been patented by Mr. John P. Mern, of New York City. The object of this invention is to provide for basins, tubs, sinks, etc., a faucet that cannot leak, even under great pressure, and that cannot accidentally be turned the wrong way and left running when its mouth is not over the basin or tub.

Mr. Charles P. Rood, of La Fargeville, N. Y., has invented a mattress adapted for use on shipboard, and constructed so that it may be used as a life-preserving raft when required for such purpose; and the invention consists in the combination, with a mattress of usual character, of watertight cells or compartments, that render the mattresses buoyant in water, and fit them for use as a raft singly or by connecting a number of them together.

A simple and effective refrigerator for cooling and preserving meats, etc., has been patented by Mr. Frederic Wolf, of Quincy, Ill. It consists essentially of a wooden refrigerating box, with a glazed cover and front, fixed between two higher ice boxes that open into it, so that the cold air from them shall descend into it.

Mr. Thomas Leach, of Taunton, Mass., has patented an improved stand for ice pitchers, which consists chiefly in a stand having an elevated support for the tilting pitcher, which stand is constructed with an opening in its surface, and a subjacent drawer adapted to catch the drip from the pitcher. The invention also consists in forming the handle for the drawer in such a shape as to make it either a support for the goblet or a receptacle into which the waste water from the goblet may be poured, and whence it passes into the drawer.

An improvement in napkins and analogous articles, patented by Mrs. Elizabeth W. M. Cameron, of Brooklyn, N. Y., consists in providing napkins, handkerchiefs, table covers, and similar articles with embroidered or printed fancy borders, which are made separately or of separate pieces, and attached to the edges of the body of the napkin or other article by a hem-stitch.

Mr. Max Rübin, of New York city, has patented an improved fan of the kind that may be opened into circular form. It is so constructed that it may be closed into the space between the parts of the handle, and may be held securely in place both when opened and when closed.

An improvement in razors and knives has been patented by Mr. Nelson B. Slayton, of Rochester, N. Y. The object of this invention is to furnish razors which may be shut up and carried in the pocket without the necessity of putting them in cases.

A device for tightening wheel tires by raising or spreading the fellies so that washers may be inserted between the ends of the spokes and the felly or between the parts of the felly itself, has been patented by Mr. John A. Cooley, of Savanna, Ill.

Mr. Otis E. Davidson, of Clarksville, Tenn., has recently patented an improved paper bag machine, which is capable of rapidly and economically making satchel-bottomed bags having a single lengthwise seam or lap. The invention consists in novel mechanism for feeding and pasting, and also creasing the continuous web of paper, and for cutting off blanks therefrom, and folding, pasting, and pressing the latter, and discharging them from the machine as completed bags. A complete detailed description of the construction and operation of this machine would require engravings.

An improved centrifugal honey extractor has been patented by Mr. George W. Williams, of San Diego, Cal. The invention consists in the combination of a revolving extractor fitted with swinging comb holders and a cylindrical vessel. The shaft carries radial arms and hinged foraminous comb holders.

Messrs. Louis Rakow and Charles H. Kunke, of Gilbert's, Ill., have patented an improved machine for holding the hubs and spokes of wheels while the spokes are being driven. The invention consists in a combination of devices which cannot be clearly described without engravings.

Mr. Samuel P. McClean, of Range, O., has patented an improved metallic burial safe, which is intended to effectually prevent what is known as "body-snatching." The invention consists in a strong metallic case having a cover provided with locking devices of such a character that when once locked they are permanently locked, and can never be opened except by cutting through the heavy iron of the case. Devices are also provided which prevent the digging of the earth down to the case; and the case is secured so that it cannot be removed bodily for the purpose of gaining entrance to it through the bottom.

Mr. Richard Elliot, of Plainfield, N. J., has patented an earth auger provided with guards in the spiral groove, made fan-shaped to allow the earth to work up past them when the auger is working into the ground, and prevent its relapse as the auger is pulled out.

Mr. Henry P. Schneck, of Huntingburg, Ind., has patented an improved hay carrier which consists of a frame having wheels and sliding on an elevated rod or track, and provided with a bottom sliding plate moved by the contraction of a spring, and also having a sliding bar and clutch, the whole being arranged so that it may be moved and operated in opposite directions.

An improved truck for loading locomotive tenders has been patented by Mr. Mark A. Dees, of Scranton, Miss. The object of this invention is to construct apparatus for loading wood or coal upon locomotive tenders in the required quantity at once in place of tossing the fuel by hand, as usually practiced, thereby saving time, and, in the case of wood, packing it more closely on the tender. The invention consists in a truck adapted for being moved on a track by means of a rack and pinion, whereby one end may be projected over the tender, and fitted at its end with a tilting platform for receiving the fuel and discharging it.

Mr. Carroll J. Atkins, of Louisiana, Mo., has invented an improved elevator for putting ice from water into a house. The horizontal part of the elevator is to set into the water deep enough to allow the ice to be floated into it, while the inclined part extends up to the house to the height, or above it, at which the ice is to be packed. The ice is drawn up the incline by means of a windlass and chains or ropes.

THE CARE OF TOOLS.

We believe—although we are not certain that it is capable of demonstration—that more tools are ruined by want of care than broken or worn out by proper use. It is surprising how ready even the thoughtful workman is to leave to neglect the tool which has just subserved his purpose. Carelessness in the use of tools is a source of enormous annual expense to manufacturers and others, an expense which, if aggregated, would probably surprise even the most observant. On the farm the plow is left in the furrow, the hoe between the rows of corn, the shovel in the pit, the scythe on the tree, and the ax in the log—left to rust and to the liability of accidents. The wood-worker, called away suddenly from the job he is doing, leaves his plane on the board he has been smoothing, to be knocked off by the first passer-by, or allows the auger bit or the saw to remain in the half-pierced timber, to be broken by the first swinging board in the hands of the apprentice. The blacksmith leaves his tongs at the vise when he needs them at the anvil, and the machinist drops tap, drill, reamer, or hammer, where last used.

Order is the "first law" in the shop as in heaven, and care, no less than cleanliness, is "next to godliness." Next to the advantage of having a place for every thing is the wisdom of keeping every thing in workable condition. In the machine shop the use of impure oils in drilling, tapping, etc., is an expensive economy. Oil containing mineral or earthy matter is only a grindstone in solution. It cuts and abrades the edges of the tool, while in use, precisely as does the grindstone or buff wheel. Gummy oils are scarcely less injurious. They add to the friction of the tap or drill, and demand increased strength to resist torsion. A "gummed-up" tap or file is almost useless until thoroughly cleaned. The application of warm soapsuds, benzine, or turpentine, will not always remove this gum. In such a case they can be readily cleaned by covering them with oil, turpentine, or any inflammable substance, and exposing them for a moment to a flame until the liquid takes fire; then card or wipe them and they will be found to be in excellent order. Finishing files not unfrequently become clogged, and when the card is useless to remove the "gurry," this process will be found efficient.

Sometimes, also, in filing wrought iron the tough particles of the iron are torn off by the teeth of the file and lodge, producing scratches on the work, and thus impairing the efficiency of the tool. A simple device, which we used for years, that easily and quickly dislodges these clinging particles, is a piece of soft iron wire flattened under the hammer at one end to a chisel point, or disintegrated like a broom and used thus: The point of the file resting on the bench, the handle held by the left hand; then strike across the face of the file, in the direction of the "first cut" teeth, with the flattened end. It certainly and thoroughly dislodges the snags, and the file is ready for work. The wire instrument may have a ring turned at the handle end, or be affixed to a wooden handle. No. 8 wire is large enough.

Turning tools, after being tempered and ground, are frequently left wet from the stone until wanted for use. In this state the keen edge is acted upon by rust, and a regrinding becomes necessary. If not put at once to the oil stone they should be wiped with oily waste. These little matters are more important than they seem at first sight. A saw or chisel which has been used in unseasoned wood, should be carefully wiped and oiled, otherwise it contracts rust, and wears away fast. A new file should not be put upon the scale of cast iron or of unannealed steel, and a file kept for brass or bronze should not be used on a harder metal. Back saws for cutting iron and other metals are often ruined in inexperienced hands. If drawn forward and back too rapidly they heat and lose their temper, when they become almost useless.

A hundred other instances might be adduced to show the depreciation of tools by neglect and the necessity of paying attention to these "little things." The real economist, however, needs but a hint, while the constitutionally careless are slow to see their errors.

The Microscope in the Witness Box.

As the New York *Tribune* says, the scientific aspects of the evidence against the Rev. Mr. Hayden, of Madison, Conn., for the murder of Mary Stannard, are truly remarkable; indeed the microscopic exhibition of arsenic and the comparison of arsenical crystals show that the law has a powerful auxiliary in chemistry. After the arrest of Mr. Hayden, and the disinterment of the remains of the dead girl for examination, it was claimed that all of the arsenic which Hayden had bought was still in a box in the barn. There a box was found containing a full ounce. It was shown that the arsenic found in Mary Stannard's stomach could not have been taken from this box. At this point recourse by the prosecution was had to Prof. Dana, who visited England, studied the manufacture of arsenic, and then, by the use of his microscope on the crystals, demonstrated that the arsenic from the girl's stomach was an entirely different lot from that hidden in the barn, and that it was identical with the arsenic sold by Tyler, at the time when Hayden is known to have bought his ounce. The conclusion sought to be established is that a part of the arsenic bought by Hayden was used to poison the girl, and that the rest was flung way, and that the barn arsenic was bought elsewhere afterward merely as a blind. The crystals of the stomach arsenic are three or four times as large as those of the barn arsenic, but none of them are large enough to be visible without the microscope. Hereafter criminals will do well to recognize in science one of the agents of possible detection.

Profitable Reading.

In these days all men and women read something, but the trouble is that by reading in a single vein, which so strongly appeals to their individual tastes and personal idiosyncrasies that it is not study at all, they lose their power to study anything else. The rule for successful and profitable reading would, in the light of these facts, seem to be to read only what one does not like to read. That reading which costs no effort, and necessarily dissipates the power of study, is that which we know to be important in itself, and in its bearings upon broad knowledge and culture should most engage our time and attention. The trouble is, not that we do not read enough, but we read so much of that which simply pleases us as to destroy our power to read that which will edify and enlarge us.—*Dr. J. G. Holland.*

Probable Uses of the Telegraph.

The following curious item, headed as above, was published in the SCIENTIFIC AMERICAN, October 26, 1867, when telegraphy may be said to have been in its early infancy:

Why should not every house have its telegraph wire? When gas was first applied to purposes of illumination it was used only in the public buildings and streets, and even now on the continent of Europe it has been introduced but sparingly into private dwellings. Why may not the telegraph wire be extended and diffused—if we may say so—as the gas pipe has been? Suppose a network of such wires laid from a central point in the city to the library or sitting room of every dwelling, and an arrangement made for collecting news similar to that controlled by the associated press. Through the wires, then, this news might be instantly communicated to each family, without the work of time rendered necessary to put it into type, print it, and distribute it by means of carriers. A fire, a murder, a riot, the result of an election, would be simultaneously known in every part of the city. Of course, this would do away with newspapers, but what of that? All things have their day, and why should such ephemeral things as newspapers be an exception to the rule?

THE EJECTOR.

[*Continued from first page.*]

them after a thorough test, and after a severe competition with those of English make. Ocean and coasting steamers provided with one or more of these ejectors in each watertight compartment would have a means of keeping clear of water until the necessary repairs could be made.

It is not sufficient to say that a steamer is provided with pumps, as it is a notable fact that pumps are almost always in a state of disarrangement, whereas there is nothing in the ejector that can get out of order or be misplaced.

The upper right hand view shows the application of the ejector to the fitting of railway water tanks, and the view below it shows its application to work in breweries and chemical works.

The ejectors are made in different ways for different purposes, and persons contemplating adopting these useful instruments should address Messrs. Nathan & Dreyfus, 108 Liberty street, New York city, for further information.

Water and Fire Proof Paper.

A water and fire proof paper lately patented is made by putting a mixture of ordinary pulp and asbestos reduced to pulp in the proportion of about two-thirds of the former to one-third of the latter into a strong solution of common salt and alum. This mixture is put through the engine and then run off through a Fourdrinier. The paper thus made is run through a bath of gum shellac dissolved in alcohol or other suitable volatile solvent of that gum, and subsequently through ordinary calender rolls, after which the paper is ready to be cut into such sized sheets as may be required for use. The effect of the strong solution of salt and alum upon the paper is to greatly strengthen it and to increase its fire-resisting qualities. The shellac bath to which it is treated is said to cause the paper to become thoroughly permeated with the gum, so the paper becomes water-proof to such an extent that long boiling in water does not disintegrate it, and the presence of the gum in and upon the surface of the paper seems to present no obstacle to the proper and usual absorption of ink, either printing or writing. Thus, by the combination of the asbestos, salt, and alum in the paper, it is rendered so far fire-proof that a direct exposure to an intense fire does not burn up the substance of the paper to an extent that interferes with safely handling it, and when exposed to great heat in books, or between metallic plates, a number of sheets together, it is much less injured by the fire.

The addition of the gum shellac to the paper makes it, for all practical purposes, water-proof, so that if account-books, valuable documents, bank bills, and other monetary papers for which this paper is used be subjected to the action of fire and water, either one or both, in a burning building, they will not be injured to such an extent as to destroy their value.

A Large Electro-Magnet.

Mr. Charles Reitz, of Indianapolis, Ind., sends us a description of a large electro-magnet made by him for Professor Zahm, of the University of Notre Dame. The length of the cores is 30 inches, diameter 4 inches. Heads, of rubber, ½ inch thick, 9 inches in diameter. The yoke is 3¾ inches thick, 6½ inches wide, and 18 inches long, with 3 inch slots to admit of moving the cores. The bolts which connect the cores with the yoke are 1¼ inches in diameter. The cores are wound with eight layers of No. 6 cotton covered copper wire, the wire being wound double, and the alternate layers being provided with terminals, which are connected with a plug switch on the baseboard, so that the electric current may be sent through the coils in various ways. The magnet is provided with two sets of pole extensions for diamagnetic experiments, one set being conical, the other flat. The armature is 15 inches long, 3 inches thick, and 4 inches wide.

Different effects may be produced in this magnet by connecting the coils with the battery in different ways. The changes that may be made in this way are almost without number. It is estimated that the magnet, with proper battery power, will lift three tons. The weight of the magnet and its attachments is 800 pounds.

The Maryland Ship Canal.

The route chosen for the proposed ship canal between Chesapeake and Delaware bays begins at Queenstown, Maryland, and runs across the peninsula to Lewes, Delaware, discharging into Delaware Bay, five miles above the Delaware breakwater; distance, 51 miles. It is proposed that the canal shall be 200 feet wide and 25 feet deep, with tide locks only. The entire line will have to be dug; estimated cost, $31,000,000. The saving in distance between Baltimore and any Northern port will be 225 miles.

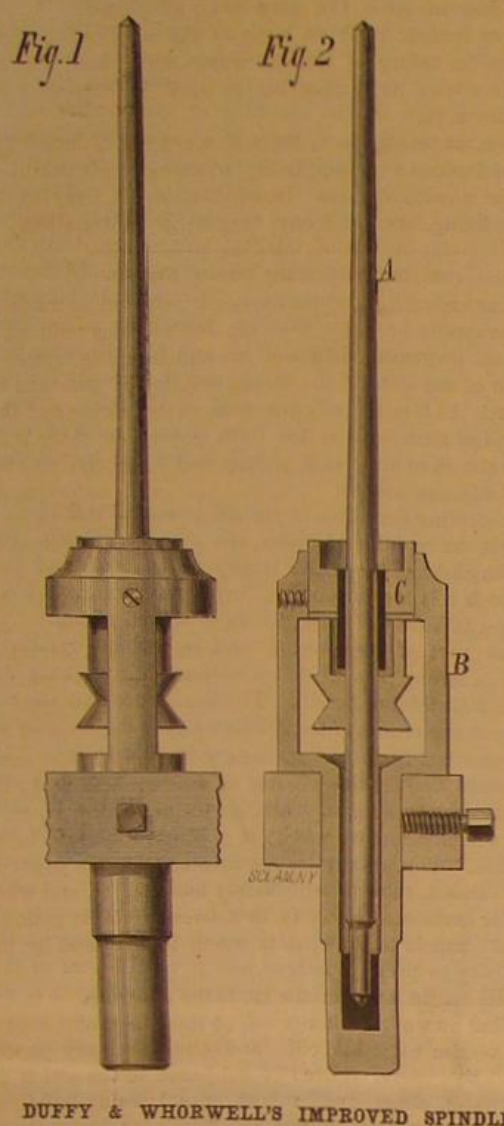
Value of Knowledge.

It is affirmed that "a little knowledge is a dangerous thing." The saying may be true, but it is not necessarily true. I cannot help thinking that it is a great advantage to you to gain as much knowledge as you can, of as many subjects as you can, and not to be deterred by any fear that your knowledge, being superficial, may lead you into error. Of course, the danger is that a person, who knows only a little of a subject, may fancy himself well qualified to give an opinion on points that are really out of his depth; but as long as a person feels and knows that his knowledge of a subject extends only so far, and does not venture beyond

his depth, that person has everything to gain and nothing to lose by getting some knowledge of it, even though the knowledge may be limited.—*Hon. W. E. Gladstone, M. P.*

AN IMPROVED SPINDLE.

We give herewith a side elevation and sectional view of an improved spindle and bolster patented by Messrs. Joseph Duffy & Henry Whorwell, of Paterson, N. J. The object sought by the inventors is to provide a bolster which will properly support the spindle, and yet permit of readily removing the spindle and its whorl when occasion requires, and to facilitate the lubrication of the spindle bearings.



DUFFY & WHORWELL'S IMPROVED SPINDLE.

The spindle, A, revolves in its bolster, B, which is secured in a socket in the supporting rail by means of a set screw. The tubular lower portion of the bolster, together with the bridge piece that supports the upper bearing of the spindle, are formed of a single piece, and the sleeve, C, in which the spindle revolves is of the same diameter as the whorls, so that when the sleeve is loosened the spindle, together with its whorl, may be removed from the bolster. An annular oil cup is formed in the upper end of the sleeve, C, and an annular collar formed on the upper side of the whorl incloses the lower end of the sleeve, C, and returns to the bearing the oil that runs through the sleeve.

We understand that three frames, containing in all 900 spindles of this improved kind, have been built by the Danforth Locomotive and Machine Works, and are now in operation in the Watson Works at Paterson.

This spindle can be readily adapted to frames now running inferior spindles. The inventors claim that this spindle is clean, economical, free running, and substantial.

Further information may be obtained by addressing Messrs. Duffy & Whorwell, at the Danforth Locomotive and Machine Works, Paterson, N. J.

THE OTTER.

Although by no means a large animal, the otter has attained a universal reputation as a terrible and persevering foe to fish. Being possessed of a very discriminating palate, and invariably choosing the finest fish that can be found in the locality, the otter is the object of the profoundest hate to the proprietors of streams and by all human fishermen. It is so dainty an animal that it will frequently kill several fish, devouring only those portions which best please its palate, and leaving the remainder on the banks to become the prey of rats, birds, or other fish-loving creatures

For the pursuit of its finny prey the otter is admirably adapted by nature. The body is lithe and serpentine; the feet are furnished with a broad web that connects the toes, and is of infinite service in propelling the animal through the water; the tail is long, broad, and flat, proving a powerful and effectual rudder by which its movements are directed; and the short, powerful legs are so loosely jointed that the animal can turn them in almost any direction. The hair which covers the body and limbs is of two kinds, the one a close, fine, and soft fur, which lies next the skin and serves to protect the animal from the extremes of heat and cold, and the other composed of long, shining, and coarser hairs, which permit the animal to glide easily through the water The teeth are sharp and strong, and of great service in preventing the slippery prey from escaping.

The color of the otter varies slightly according to the light in which it is viewed, but is generally of a rich brown tint, intermixed with whitish-gray. This color is lighter along the back and the outside of the legs than on the other parts of the body, which are of a paler grayish hue. Its habitation is made in the bank of the river which it frequents, and is rather inartificial in its character, as the creature is fonder of occupying some natural crevice or deserted excavation than of digging a burrow for itself. The nest of the otter is composed of dry rushes, flags, or other aquatic plants, and is purposely placed as near the water as possible, so that in case of a sudden alarm the mother otter may plunge into the stream together with her young family, and find a refuge among the vegetation that skirts the river banks. The number of the young is from three to five, and they make their appearance about March or April.

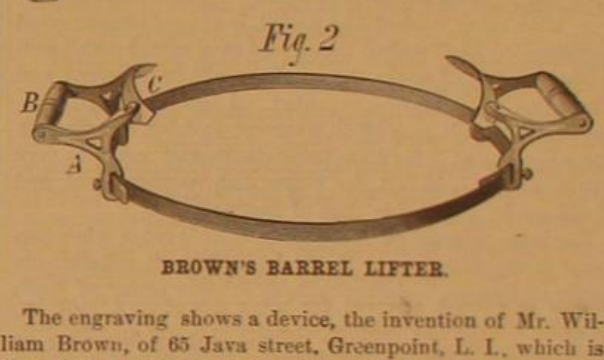
On account of the powerfully-scented secretion with which the otter is furnished by nature, it is readily followed by dogs, who are always eager after the sport, although they may not be very willing to engage in single fight with so redoubtable an opponent. An otter has been known to turn savagely upon a dog that was urged to attack it, to drag it into the water, and to drown it. The best dogs for the purpose are said to be the otter hounds. Even human foes are resisted with equal violence.

The fur of the otter is so warm and handsome that it is in great request for commercial purposes. The entire length of the animal is rather under three feet and a half, of which the tail occupies about fourteen or fifteen inches. On the average, it weighs about twenty-three pounds; but there are examples which have far surpassed that weight. Mr. Bell records an instance of a gigantic otter that was captured in the river Lea, between Hertford and Ware, which weighed forty pounds.

THE OTTER.—*Lutra Vulgaris.*

NEW BARREL LIFTER.

It is difficult to conceive of a more ungainly and inconvenient object to handle than a common barrel. It is very well calculated for rolling about on a level surface, but when it is desired to lift it from one level to another, as from the ground into a wagon, for example, or carrying it up and down steps or stairs and through narrow passages, it is quite a difficult matter



BROWN'S BARREL LIFTER.

The engraving shows a device, the invention of Mr. William Brown, of 65 Java street, Greenpoint, L. I., which is intended to facilitate the handling of barrels. It is a very simple and efficient contrivance, and is adapted to barrels of different sizes. It consists of two pairs of triangular castings, A, each pair being connected by a handle, B, and a curved iron or steel bar, C, at the top, and the iron hoop which surrounds the barrel passes through mortises in the lower arms of the castings and is held in place by set screws. The hoop may be adjusted to barrels of different sizes by loosening the set screws and sliding the ends of the hoop one way or the otherthrough the castings.

The manner of applying the lifter will be clearly understood by referring to Fig. 1 in the engraving. An upward strain upon the handles puts a lateral strain upon the hoop, and brings the curved bars, C, against the side of the barrel with sufficient force to admit of lifting it by the handles. A patent is pending for this invention in the United States Patent Office. Further information may be obtained by addressing the inventor as above.

NATURAL HISTORY NOTES.

Ferns and their Uses.—The beautiful plants belonging to the order of ferns, although mostly collected and cultivated for ornamental purposes, have some economic and medicinal uses, although perhaps not very important ones. The male fern (*Aspidium filix mas*) and the marginal shield fern (*A. marginale*) are used as a valuable remedy for tape-worms, and an African species (*A. athamanticum*), as well as the female fern (*Asplenium filix fœmina*), the dwarf spleenwort (*A. trichomanes*), the wall-rue fern (*A. ruta-muraria*), the hart's-tongue (*Scolopendrium vulgare*), the common brake (*Pteris aquilina*), and a few others, are regarded as having the same properties, and have been used for the same purposes. The common polypody (*Polypodium vulgare*) was formerly regarded as a cholagogue, and was given in head diseases. The flowering fern and cinnamon fern (*Osmunda regalis* and *Cinnamomea*) are regarded as demulcent, sub-astringent, and tonic, and the former yields a fine mucilage useful in summer complaints.

Several species of moonworts (*Ophioglossum* and *Botrychium*) were formerly regarded as vulneraries. Some species of maidenhair (*Adiantum*) have feeble, aromatic, demulcent properties, and are used for forming the sirup called "capillaire." A Peruvian species of *Polypodium* has some reputation in fevers and other maladies; and the down from the stem of some *Cibotium* has been much recommended as a styptic, under the name of Penghawar Djambi—its action being probably merely mechanical, as chemical analysis has shown no active principle. A similar substance is gathered in Madeira from *Dicksonia culcita* to stuff cushions. The rhizome of *Phymatodes leiorhiza*, when dry, smells and tastes like licorice. A small species of *Grammites*, of Peru, is so odoriferous when dry that it is used by the Indian women as an agreeable perfume. The long creeping rhizome of a variety of the common brake (*Pteris aquilina*) was formerly much used for food in New Zealand. It abounds in starch and mucilage; but if this variety is no more palatable than our own, it is very undesirable food. The rhizome of our own variety of the brake when roasted has a slimy consistence and disagreeable taste and odor. If the rhizome, however, after being washed and peeled, is scraped so as to avoid including the hard walled tissue, and then mixed with a sufficient quantity of water, the mucilage will be dissolved, and after a few hours may be decanted. A little colorless, tasteless mucilage will pass off on a second washing, and the residue when baked is far from unpalatable, and must be very nutritious. It is in fact far better than cassava bread, and would not be despised in time of famine.

The large rhizome of *Marattia salicina* is eaten when prepared in the same way as the brake. The soft cellular substance of *Cyathea medullaris* affords a better article of food; and, for the same purpose, some other species are occasionally used. In a recent number of *La Nature* there is a note on this subject by M. P. Guyot, who says: "The majority of the ferns of our forests and woods contain starch and might be used as food. Still, it should be observed that when the plant has emerged from the soil it possesses an odor and taste which are repulsive, and which render its uses impossible. It is the same, however, with asparagus; and, like the latter, the stalks of ferns can only be directly eaten before they have grown above the soil and undergone the greening action of the sun's rays; in this state they are fleshy, white, and tender, and as to quality greatly resemble the shoots of asparagus. The principal edible species of our forest ferns is the male fern, and the commonest is the one that resembles a little palm tree. A well known landscape painter reckons among his claims to glory the invention of fern-shoot omelets. In France, however, the consumption of fern-shoots is very limited, and they are eaten only out of simple curiosity. Not so in Japan, for during the spring and summer season the inhabitants of the high clayey mountains derive almost the whole of their food supply from ferns, which they call warabi. In the spring they eat the young fronds, and later on they consume the starch that they extract from the rhizomes. The preparation of this is very simple. They begin by washing the roots to remove the earth, then crush them with a mallet, and afterward stir up the *débris* in water contained in reservoirs hollowed out of tree trunks. The water containing the starch is then drawn off into other reservoirs placed beneath and allowed to settle. By this means the amount of starch obtained is about 15 per cent of the weight of the rhizomes employed. Every hamlet has a special place assigned for this operation; and the products of these washings form large masses there that testify to the importance of this manufacture. It is to insure the reproduction of these ferns that the inhabitants, every two or three years, burn the herbs and underbrush, which spring up in the shade of the oaks and chestnuts."

Several ferns, when burnt, produce ashes useful for manure, or as crude matter for the chemists.

Simulation of Death by Insects.—In an interesting paper read not long ago before the Entomological Society of England, the simulation of death so freqently observed among insects was regarded not as an intentional stratagem to escape danger, but as a species of catalepsy due to terror, and was compared to the so-called fascination which certain birds and small mammals experience in presence of a snake. It would seem that the tendency to such simulation in different species is inversely as their locomotive powers. Thus, as far as the true insects are concerned, shamming death is most common among the coleoptera, the order whose locomotive faculties are upon the whole lowest. Looking again at the different groups of coleoptera, we find the tendency to simulate death absent, or at least very rare, among the tiger beetles, carabs, and the geodephaga generally; among the long-horns, which, when alarmed, rise in the air almost as readily as do bees or diptera; among the staphylini, which both fly, run, and fight well, and among the elateridæ, which escape danger by a sudden leap. On the other hand, the semblance of death is often put on by the lamellicornes, which are slow crawlers, blundering fliers, and are incapable of taking wing without some time for preparation. All these properties are still more decided in the genus *Byrrhus*, and here accordingly we find simulation at its height. At the mere sound or vibration caused by an approaching footstep, human or brute, one of the latter insects draws in its legs and assumes very effectively the appearance of a small stone or rounded clod of earth. Among spiders the same distinction may be traced. The slower and more sedentary forms, if in presence of a powerful enemy, roll themselves up in a ball, and may easily pass unobserved. On the contrary, the wandering ground spiders, such as the *Lycosæ*, which in warm weather bound with such rapidity that they are sometimes by careless observers supposed to fly, rarely resort to this stratagem except when very persistently teased and intercepted.

The Origin of our Domestic Animals.—Palæolithic man, who existed for so long a period in Western Europe during the quaternary age, was probably indigenous there. But at the commencement of the neolithic age a new civilization was suddenly introduced, and a new type of man appears upon the scene. Neolithic man, with his polished stone implements, brings with him a number of domestic animals—the dog, the goat, the sheep, the ox, the horse, and the pig. By studying the origin of these animals, and determining their ancestral home, light may obviously be thrown upon the source whence the neoliths emigrated. Such a study has been undertaken by Professor Gabriel de Mortillet, who has contributed an interesting paper on this subject to the current number of M. Cartailhac's "Materials for the History of Man." Neolithic man, according to the author, came from Asia Minor, from Armenia, and the Caucasus. These, in fact, are said to be the only countries which could have yielded the assemblage of domestic animals and cereals which the neoliths brought with them upon their invasion of Southwestern Europe during the Robenhausen period.

A Remarkable Spider's Web.—A writer in *Nature* says: A large spider, of a genus common all over Polynesia, and also in New Caledonia (where formerly much eaten by the aborigines) produces a very strong, thick web. On Sundays, generally, when no work is going on in the plantations, the imported Pacific Islanders amuse themselves by wandering about the bush, armed with a framework of cane in the shape of an elongated cone, affixed to a long stick. This they twist and twist, round and round in the spider's webs, till it is coated sometimes half an inch thick with the viscous fabric. They then untie the fastenings and draw out the strips of cane, when the bag becomes like a long old-pattern night-cap. I have one before me now, over a yard long, a foot across, and pretty thick, which does not weigh one ounce! It is yellow; the New Caledonian ones are usually gray. Some of the New Caledonian ones are stretched tight enough to resemble an Indian suspension "tom-tom," and really emit a slight sound on being tapped.

The Fertilization of Red Sea-Weeds.—The agency of insects in securing the due fertilization of many flowering plants has been much written about, and is now well understood. In a recent number of "Kosmos" Dr. Dodel Port, the eminent botanist of Zurich, has published the results of a series of observations made by him regarding the part played in the fertilization of a certain species of *Floridex*, or red seaweed, viz., *Polysiphonia subulata*, by animalcules. He finds that certain wheel-animalcules, or *Vorticellæ*, which grow upon the sea weed, create, by means of the constant motion of their cilia, a current which bears the sperm cells—the representative of the pollen grains—from the male plant to the stigma-like end of the germ case of the female plant. The paper is of great biological importance, since it forms, so far as our knowledge extends, the first record of the participation of animals in the fertilization of cryptogams, which in itself is an interesting parallel to the relations existing between insects and phænogams.

The Correlation of Mutilation of Insect Larvæ with Deformity in the Imago.—In the *Comptes Rendus* of the Belgian Entomological Society for July, of the present year, there is a notice by M. Melise of experiments made by him to determine the effect produced on the perfect insect by mutilation of the larva. M. Melise operated upon ten selected silkworms by cutting off the right metathoracic leg of each. All went through their transformations, and the operation apparently caused little inconvenience, for they recommenced feeding again immediately afterward. The effect produced on the moths produced from these larvæ was as follows: One was deprived of three tarsal joints, but the claw was developed. Three had only the femur and tibia. One had the leg "amputated" in the middle of the femur. The two others had only a stump, scarcely a millimeter in length. The author adds that in not one of the moths was the leg absolutely absent, and that the variation in the amount of deformity probably resulted from the difficulty of performing the amputation in the larvæ at precisely the same place in each. In the case of insects with incomplete metamorphoses parallel experiments have often been made, and with similar results; but with lepidoptera they have been so few as to render confirmatory evidence of the statements of other experimenters of much value.

Macrobiotics and Eubanics.

The *Evening Post* makes a translation from a portion of an interesting little book in the German language published at Bonn, from the pen of Dr. Wilhelm Schmoele, well known in this country as a physician of eminent acquirements, which is likely to attract a good deal of attention. The work is entitled "Macrobiotics and Eubanics"—Macrobiotics being the art of prolonging life, and Eubanics being the art of walking well.

Dr. Schmoele explains, in that part of the book which relates to Macrobiotics, the germinal and progressive phenomena of human life from birth to death, and the organic and chemical nature of vital processes, seeking to discover inductively what physicians call the "indications" for treatment with a view to the checking of decay after middle life, when, as we all know, there is a constantly increasing excess of demand over supply in the matter of vitality. Dr. Schmoele is convinced that in addition to the influence of hygienic living, specific means may be profitably employed in checking this decline of vitality, postponing death from vital exhaustion, and especially adding vigor and efficiency to body and mind in advanced age. In common with physicians generally he holds that the infirmities of age come earlier and are greater than need be, and his effort has been to find in observed facts the reason and the remedy for this. He regards the free use of citric acid, in the form of lemon juice, and of lactic acid in the form of sour milk of every kind, as the remedies most plainly called for by the facts scientifically considered.

In considering the effect of certain abnormal influences in increasing the rapidity of decay, the author suggests some of the principles of a broader theory of diagnosis and treatment which it is his purpose to expound more fully to the profession in a future work, if life is spared to him.

In that part of the present treatise which relates to Eubanics a strong plea is made for systematic walking as a means of maintaining health. The abundance and the convenience of our means of transportation, the author believes, bring to modern life a serious danger in this respect. Unless we walk upon principle and in consequence of a conviction of the necessity of walking, we are liable to abandon the practice almost wholly in our haste and our self-indulgence. The author is convinced that there is danger here of serious race deterioration, and he very earnestly pleads for caution. Going further he seeks to remove the principal obstacle to the general practice of walking, namely its tendency to produce fatigue and to repel lovers of physical ease; he finds in certain rhythmic principles a means of learning to walk with the least possible fatigue, giving to the exercise something of the charm that dancing possesses. The system, which is fully explained in the book, is founded upon a study of the principles involved in dancing, and especially in the German waltz, which, as is well known, a good dancer may continue without fatigue much longer than most persons can walk with comfort, stepping with anything like equal rapidity.

Seeds.

At the last meeting of the British Association Sir John Lubbock read an interesting paper on seeds. He commenced by calling attention to the difference presented by seeds, some being large, some small, some covered with hooks, some provided with hairs, some smooth, some sticky, etc. He gave the reasons of these peculiarities, and then spoke of the modes of dispersion, by means of which seeds secured a sort of natural rotation of crops, and in other cases were enabled to rectify their frontiers. Some plants actually threw their seeds, some were transported by the wind, and many were provided with a wing which caught the wind. Dispersion was also effected by the agency of animals. This means was divided into two classes, where seeds adhered to animals by hooks, and where the same purpose was effected by sticky glands. The next point touched upon was, that seeds found themselves in spots suitable for growth. Most seeds germinated on the ground, but there were instances, as the mistletoe, where they were parasitic on trees. Such seeds were embedded in a viscid substance, so that if dropped by a bird on a bough they adhered to it. In some cases plants buried their own seeds, and in other instances the seeds buried themselves, the means by which these processes were effected being fully explained by Sir John, who, in conclusion, called attention to mimicking seeds, such as the scorpiurus, the pods of which did not open, but looked so exactly like worms that birds were induced to peck at them and thus free the seeds. That this was the purpose of the resemblance he would not assert, but he threw it out as a matter for consideration.

Alcohol by Electricity.

Berthelot's experiment was conducted as follows: "A battery of from six to eight Bunsen elements was arranged in connection with an oscillating commutator, so as to give alternately positive and negative currents twelve to fifteen times a second, to two cylinders of spongy platinum, acting as electrodes. These platinum cylinders were immersed in acidulated water, and the contacts were so arranged that neither oxygen nor hydrogen was disengaged, the water being reformed as soon as decomposed. Thus regulated, the electrodes of the apparatus were immersed in an aqueous solution of glucose." In this way alcohol was formed, although in very small quantities, but it is expected that when some improvements in the apparatus are made, the process will be much more rapid.

Openings for Industrial Enterprise in California.

The Baltimore *Sun* has in California a correspondent whose letters are always replete with practical information and good sense. In a recent communication he says: Millions for speculation, but not a dime for industry, is what is the matter with San Francisco. The leading commercial paper intimates that it is not the industry of the Chinese, but the laziness of the whites and the industrial abhorrence of capital, that causes the general prostration, and that is sure to retard our recuperation indefinitely. What California requires is a large accession of a more industrious race. We want men inclined to invest in manufactures· we want farmers, not mere wheat growers and soil robbers. But with these must come capital. There is immense overstock of capital here for gambling in stocks, cornering in merchandise, lot speculating, and for all purposes involving no industry. But for manufacturing not a dime. Our wool and hides we send 19,000 miles, via Cape Horn, to be made into cloth and shoes, and brought back to us. These, if we had New England industry and capital, we should be making at home. We send away furs and felting to be made into hats and wraps. Our agricultural machinery we import. Even soap and candles also. Though we have the best white vinegar and vegetables, we import pickles. Hogs runs wild, yet we buy hams, flitches, and lard abroad. Nearly all our coal oil is from Pennsylvania, yet we have twice as large a range of coal oil of our own. We buy vast quantities of hydraulic cement abroad, yet not excepting Portland, England, there are nowhere more nor finer materials for making it than at our Santa Cruz.

We buy all our iron and stock—an enormous amount—while iron ore, fuel, and lime are right at hand. Foreign beer and ale cost us extravagantly, while our hops and barley are far superior to all foreign growth. Even butter and cheese we import largely, to our shame. Cranberries, chiccory, hops, and oatmeal, crackers, olives, raisins, fruit-preserves, prunes, nuts, tobacco, and cotton we buy, while we have every facility for raising them here, always excepting industry Every bushel of grain we use and ship is packed in East India sacks, which we can cheaply make from our own wild textiles.

We even import foreign wines largely adulterated, while our country is covered with vineyards and our own wines are pure, wholesome, and well flavored. We could extend the list, but enough is given to show what a field there is here for profitable industry in the most genial climate in the world, and in a land literally flowing with milk and honey, and teeming with every variety of food to gladden the heart and tickle the bowels of the faithful. After this expose let no man say: "There is no chance for industry; everything is overdone." On the contrary, nowhere on this broad earth has any nation such inducements to offer to willing hands and hearts. . . . There are here mines of copper, antimony, manganese, and chrome that can be got for a song. Farmers can raise cotton, but we have no factories to buy it. Silk, also, but no reelers to buy the cocoons. Tea gardens would cover our hill lands, but there is no industry to manipulate and prepare the leaves. We have 20,000 idle hands waiting for something to turn up, grinning at all these waiting industries and wondering why other people do not go to work.

Cheiloangioscopy.

Among the most interesting sights to be viewed with the microscope is the circulation of the blood in a living frog's foot. The membrane is stretched by means of clips upon the stage of the instrument, and when the proper lenses are applied the movement of the blood may be observed rushing along with force like a mill stream.

Hitherto, says the *Nineteenth Century*, except in the case of Perkinje's experiment, in which an observer can see the circulation in his own retinal blood vessels, the evidence of circulation in the human subject has been entirely circumstantial, derived from the facts of structure of the circulatory organs, and from the manner in which the blood flows from several arteries and veins. But by means of a simple arrangement, invented by Dr. C. Hüter, of Greifswald, it is now possible to witness the actual flow of blood in the blood-vessels of another person, and that with sufficient accuracy to detect any abnormality in the circulation, and so to obtain invaluable assistance in the diagnosis of disease.

In Dr. Hüter's arrangement the patient's head is fixed in a frame, something like that used by photographers, on which is a contrivance for supporting a microscope and lamp. The lower lip is drawn out, and fixed, by means of clips, on the stage of the microscope, with its inner surface upward; a strong light is thrown on this surface by a condenser, and the microscope, provided with a low-power objective, is brought to bear upon the delicate network of vessels, which can be seen in the position indicated even with the naked eye.

The appearance presented is, at first, as if the vessels were filled with red injection. But by focusing a small superficial vessel the observer is soon able to distinguish the movement of the blood stream, rendered evident by the speck-like red corpuscles, the flow of which, in the corkscrew-like capillaries, is said by Hüter to be especially beautiful. The colorless corpuscles are distinguishable as minute white specks, occurring now and again in the course of the red stream. Besides the phenomena of the circulation, the cells of pavement-epithelium lining the lip, and their nuclei, can readily be distinguished, as well as the apertures of the mucous glands.

Besides the normal circulation, various pathological conditions can be observed By a pressure quite insufficient to cause pain, the phenomena of blood stagnation—the stoppage of the flow, and the gradual change in the color of the blood from bright red to purple—are seen. A momentary stoppage is also produced by touching the lip with ice, a more enduring stasis by certain reagents, such as glycerine or ammonia.

Hüter states that he has already proved the great use of "cheiloangioscopy," as he calls the new process, in his medical practice. The variation in the blood-flow and in the diameter of the vessels, the crowding together of the red corpuscles, the increase in number of the white corpuscles, occurring in certain diseases, all these may be observed readily and exactly. It will, indeed, be at once obvious how great is the importance of a method like this, by which an actual observation of the circulation is made possible, especially when it is borne in mind that even the rough and ready method of feeling the pulse affords a valuable indication of the state of health.

Balling's Saccharometer.

This is the instrument which is usually employed by continental brewers for testing the gravity of their worts and beers, and as it is often referred to in foreign technical papers quoted in our pages, we give a short explanation of its graduation. Balling's saccharometer is usually made of glass, with a well of mercury as a weight, in this respect resembling some of our English saccharometers; the graduation of the stem, however, is very different, as it is arranged to indicate the weight of sugar contained in 100 parts by weight of a pure sugar solution. For example, if Balling's saccharometer be placed in a solution of sugar and sink to the line marked 20, it indicates that 100 parts of the sugar solution contain 20 lb. of sugar, or, in other words, 20 per cent by weight. The degrees Balling are therefore the percentages by weight, and in this respect the instrument is very simple. In the following table we give the degrees Balling from 1 to 20, with the corresponding specific gravities of the solution, which may be useful for reference:

Degrees Balling.	Specific gravity.	Lb. per barrel.
1	1·0039	1·4
2	1·0078	2·8
3	1·0117	4·0
4	1·0157	5·5
5	1·0197	7·0
6	1·0237	8·5
7	1·0278	10·0
8	1·0319	11·5
9	1·0360	13·0
10	1·0401	14·5
11	1·0443	16·0
12	1·0485	17·5
13	1·0528	19·0
14	1·0570	20·5
15	1·0613	22·0
16	1·0657	23·5
17	1·0700	25·2
18	1·0744	26·8
19	1·0787	28·2
20	1·0832	30·0

In round numbers, each degree Balling corresponds to 1½ lb. per barrel; it must be borne in mind that the degrees Balling represent percentages of pure sugar, and not percentages of malt extract.—*Brewer's Guardian.*

Improvement in Silvering Glass.

The plan of coating mirrors with a thin film of silver, though superior to the old amalgamating process, has some drawbacks. The ordinary treatment is as follows: The glass is laid on a horizontal table of cast iron covered with a woolen cloth and heated to 40 deg. Centig (104 deg. Fahr.) On the glass, previously well cleaned, are poured successively a solution of tartaric acid, and then another of ammoniacal nitrate of silver. Under the influence of the heat the organic acid reduces the metallic salt, and after about 20 minutes the silver is deposited on the glass in adherent layers; the whole operation does not occupy more than an hour. The mirror is then dried and the metal covered with a varnish sufficient to protect it from friction and the action of sulphur vapors, which blacken it. But silver deposited in this way often has an unpleasant yellowish reflection. M. Lenoir, of Paris, turned his attention to discovering a process which would obviate this drawback. He has succeeded by the following means. The glass, once silvered, is subjected to the action of a dilute solution of the double cyanide of mercury and potassium, when an amalgam of white and brilliant silver is formed, adhering strongly to the glass. To facilitate the operation and utilize all the silver employed, M. Lenoir, by a recent improvement, sprinkles the glass at the moment the mercurial solution is applied with a very fine powder of zinc, which precipitates the mercury and regulates the amalgamation. Mirrors thus treated no longer give, it is said, the yellowish images of the silver used alone, but the white and brilliant reflection of the old process, without the emanation of vapors which would be injurious to the men employed upon the operation.

How to Medicate a Pig.—At a recent meeting of an English farmers' club, Prof. McBride spoke of the difficulty of administering medicine to a *pig*. He said: To dose a pig, which you are sure to choke if you attempt to make him drink while squealing, halter him as you would for execution, and tie the rope end to a stake. He will pull back until the rope is tightly strained. When he has ceased his uproar and begins to reflect, approach him, and between the back part of his jaws insert an old shoe, from which you have cut the toe leather. This he will at once begin to suck and chew. Through it pour medicine, and he will swallow any quantity you please.

Some Facts about Cotton.

In a recent letter Mr. Edward Atkinson, of Boston, shows by comparison of results the enormous economic superiority of free labor over slave labor, in the cultivation of cotton. The crop of cotton of 1878 and 1879 was the largest ever raised. The ten crops of 1852 to 1861, inclusive, being the last crop raised by slave labor, numbered 34,995,440 bales. The ten crops of 1870 to 1879, inclusive, being the ten last crops raised by free labor, numbered 41,454,743 bales. The excess of the ten years of free labor amounts to 6,459,303 bales. The value of the ten last crops, of which about two thirds have been exported, has been not less than $2,500,000,000, and has probably amounted to $3,000,000,000. The increase is progressive, the excess of the five last crops over the five crops immediately preceding the war has been 3,932,415 bales. . . .

The world's crop of cotton is now equal to ten to twelve million bales of the average weight of American cotton, probably the latter. Of this quantity five million bales are raised in the United States, and between six and seven million bales are spun and woven upon machinery contained in large factories in Europe and America. The rest is spun and woven by hand, and there is probably a larger portion of the population of the globe still insufficiently clothed in hand-made goods than are clothed in those furnished by the factories of Europe and America combined. The average work of one operative working one year in Lowell will supply the annual wants of 1,600 fully clothed Chinese or 3,000 partly clothed East Indians. No country in the world, except Egypt, produces any substantial quantity of cotton so well adapted to work upon modern machinery as that of the Southern States. Nearly one half the world remains to be conquered by cotton and commerce. To the cotton fields and factories of the United States will not the increase surely come as commerce slowly but surely opens the way?

The whole cotton crop of the world could be raised on a section of Texas less than one twelfth of its area; or could be divided between any two of the other principal cotton States without exhausting one half of their good lands, or it could all be raised on less than one half the Indian Territory that is not yet occupied at all.

Touching the cost of raising cotton in the South, Mr. Atkinson suggests the opinion that if the cost of labor be measured by its effectiveness as well as by the measure of the money with which it is paid, there is no place in the world where so effective an amount of manual labor can be procured at so little cost as in the employment of negroes upon our Southern cotton fields. The price of bacon and corn gauges the cost of cotton. Eaten together they are digestible and nutritious—eaten separately quite otherwise. They constitute the food that the negro field hand freely chooses. Three and one half pounds of bacon, one peck of meal, and one quart of molasses or sirup constitute the week's ration of an adult man or woman. This ration has been lately and can now be supplied at a cost of thirty-eight to forty-two cents per week, or six cents or less per day. The plat of sweet potatoes and fish from the ponds and rivers serve for the rest.

The Chicago Stock Yards.

In a report on the treatment of live stock on the railways, made by Mr. Zadok Street, to the American Humane Association, at its recent meeting, we find the following facts relative to the great stock yards at Chicago. These are the most extensive in America, probably in the world.

They have 1,000 cattle pens, 1,200 hog and sheep pens, and stabling for 1,200 horses. Fifteen hundred cars of stock can be unloaded and cared for daily. The system of railways extending into different parts of the Western States, thousands of miles, center there. They occupy 350 acres of land, and cost nearly $5,000,000. Their repairs cost about $150,000 annually, and it requires 700 men constantly employed in and about the yards to do the work required. They will accommodate about 10,000 cattle, 120,000 hogs, 5,000 sheep, and 1,000 horses at one time. The pens for hogs and sheep are covered; those for cattle are not covered.

The Way to Health.

The only true way to health is that which common sense dictates to man. Live within the bounds of reason. Eat moderately, drink temperately, sleep regularly, avoid excess in anything, and preserve a conscience "void of offense." Some men eat themselves to death, some drink themselves to death, some wear out their lives by indolence, and some by over exertion, others are killed by the doctors, while not a few sink into the grave under the effects of vicious and beastly practices. All the medicines in creation are not worth a farthing to a man who is constantly and habitually violating the laws of his own nature. All the medical science in the world cannot save him from a premature grave. With a suicidal course of conduct, he is planting the seeds of decay in his own constitution, and accelerating the destruction of his own life.

Adulteration of Geranium Oils.—The author detects fatty oils, gum resins, and other liquid hydrocarbons as follows: Into a test glass are poured 5 c.c. alcohol at 70 per cent, and 6 drops of the oil in question, and the whole is well shaken up. If the oil is pure it remains bright and clear, while sophisticated specimens turn milky. This process is of course not available for the detection of cheaper ethereal oils.—*M. Jaillard, in Wochenschrift Oel und Fett Handel.*

Remarkable Snow Storms in India.

Some interesting details of the extraordinary snowfall in Cashmere in 1877-78 are given in a paper in the just issued number of the Journal of the Asiatic Society of Bengal by Mr. Lydekker. Early in the month of October, 1877, snow commenced to fall in the valley and mountains of Cashmere, and from that time up to May, 1878, there seems to have been an almost incessant snowfall in the higher mountains and valleys; indeed, in places it frequently snowed without intermission for upwards of ten days at a time. At Dras, which has an elevation of 10,000 feet, Mr. Lydekker estimated the snowfall from the native account, as having been from 30 feet to 40 feet thick. The effects of this enormous snowfall were to be seen throughout the country. At Dras the well built travelers' bungalow, which had stood some thirty years, was entirely crushed down by the weight of the snow which fell upon it. In almost every village of the neighboring mountains more or less of the log houses had likewise fallen, while at Gulmarg and Sonamarg, where no attempt was made to remove the snow, almost all the huts of the European visitors were utterly broken down by it. In the higher mountains whole hillsides have been denuded of vegetation and soil by the enormous avalanches which swept down them, leaving vast gaps in the primeval forests and choking the valleys below with the *débris* of rocks and trees. As an instance of the amount of snow which must have fallen in the higher levels, Mr. Lydekker mentions the Zogi Pass, leading from Cashmere to Dras, which has an elevation of 11,300 feet. He crossed this early in August last year, and he then found that the whole of the ravine leading up to the pass from the Cashmere side was still filled with snow, which he estimated in places to be at least 150 feet thick. In ordinary seasons this road in the Zogi Pass is clear from snow some time during the month of June. As another instance of the great snowfall, Mr. Lydekker takes the valley leading from the town of Dras up to the pass separating that place from the valley of the Kishengunga River. About the middle of August almost the whole of the first mentioned valley, at an elevation of 12,000 feet, was completely choked with snow, which in places was at least 200 feet thick. In the same district all passes over 13,000 feet were still deep in snow at the same season of the year. Mr. Lydekker gives other instances of snow lying in places in September, where no snow had ever before been observed after June. As to the destruction of animal life, in the Upper Wardwan Valley large numbers of ibex were seen embedded in snow; in one place upwards of 60 heads were counted, and in another not less than 100. The most convincing proof, however, of the havoc caused among the wild animals by the great snowfall is the fact that scarcely any ibex were seen during last summer in those portions of the Wardwan and Tilail Valleys which are ordinarily considered as sure finds. So also the red-bear and the marmot were far less numerous than usual. Mr. Lydekker estimates that the destruction to animal life caused by the snow has far exceeded any slaughter which could be inflicted by sportsmen during a period of at least five or six years.

Women and Girls in English Mines.

It is a somewhat startling fact that there are still nearly 5,000 women and girls employed about the coal mines of Great Britain. In the official summary of persons employed in and about the mines, under the Coal Mines Act, it is stated that 21 females under the age of 13 years are employed. Of girls between the ages of 13 and 16 there are 433 employed; of young women above the age of 16 there are no less than 4,502 employed. In the mines registered under the Metalliferous Mines Act there is a larger proportionate employment of females. At the tender age of between 8 and 13 years, there are 96 girls employed, chiefly in the Cornwall district; between the ages of 13 and 18, there are 981 girls employed above these mines, Cornwall and the North Wales district employing the bulk; and there are also 1,741 females above the age of 18 employed, Cornwall, North Wales, and Ireland employing all these except 20; and of this score, somewhat singularly, the chief part are employed in the North of England, which has been remarkably free from women's work in the unfit employment of mining. The proportion of women employed is said to be decreasing; but the fact that girls of such tender ages are put to mining operations, or to work "above ground" at the mines, is a sign that the unsatisfactory symptom is not likely to entirely die out.

The Deepest Well in the World.

The sinking of the deep artesian well near Buda Pesth, Hungary, is now completed; the works were commenced as far back as 1868, and during their progress many interesting facts relating to geology and underground temperature have been brought to light. The total depth is 3,200 feet, and the temperature of the water it yields is nearly 165° Fahr. The temperature of the mud brought up by the borer was taken every day, and was found to increase rapidly, in spite of the loss of heat during its ascent, down to a depth of 2,300 to 2,700 feet. Beyond this point the increase was not so marked. At a depth of 3,000 feet the temperature was 177° Fahr., giving an average increase of 1 for every 23 feet bored. Water first commenced to well up at a depth of 3,070 feet; here its temperature was 110° Fahr., and from this point onward it rapidly increased both in quantity and temperature. Thus, at 3,092 feet, its temperature had already risen to 150° Fahr., and the yield in 24 hours from 9,500 to 44,000 gallons. Finally, when the boring had reached 3,200 feet, at which point it was stopped, the temperature of the water, as it burst from the orifice of the tube, was 165° Fahr., and the volumetric yield 272,000 gallons in the 24 hours. This yield was afterward reduced to 167,200 gallons, in consequence of the bore being lined with wooden tubes, which reduced its diameter. The water obtained disengages carbonic acid in abundance, and also contains nitrogen and a little sulphureted hydrogen, and 80 grains per gallon of fixed matters, chiefly sulphates and carbonates of potash, soda, lime, and magnesia.

Ocean Telegraph Cables.

In a recent lecture by Mr. Wm. H. Preece, he says: The deep sea portion of the Cape cable, while it differs to a certain extent from the Atlantic types, is still deficient in that absolute durability which all cables ought to have. In fact there is room for invention in this direction. Generally, one notices that, where there is a want, some one will spring up with an invention to meet that want. Here is a want that has existed for many years, but no one has invented a cable which can be said to be perfectly adapted for its purposes; so that, if any one here is of an inventive turn, let me recommend him to try his hand at inventing a cable which will give us all the requirements needed.

This cable to the Cape has one peculiarity in which it differs from any others. Now, among the various accidents to which cables are subject, there is one due to the existence of life at the bottom of the sea. We know that in different seas there are certain little insects, sometimes *Teredos*, sometimes *Xylophaga*, sometimes *Limnoria*, and others of very hard names, which have a peculiar liking for gutta percha. These little *teredos* attack us on sea as well as on land, and the trouble they cause us is sometimes immense. We suffer from them very much on the Irish coast, where the little wretches have found their way to the gutta percha, and have there scored and figured it in a very curious way, samples of which you will see on the table.

To put a check to their boring instinct, the Telegraph Construction and Maintenance Company, who made the cable which is being laid to the Cape, but which was originally intended for Australia, have surrounded the gutta percha with a wrapping of brass; and if any of these boring insects abound in any portion of the line where this brass wrapping is used, I have no doubt that the brass will be too much for them, and that they will find themselves terribly beaten in making any attempts to get at the gutta percha.

It is found that these little animals do not exist at greater depths than 100 fathoms, and, therefore, in the deep sea portion of this cable the brass wrapping will not be found.

There are a great many accidents to which submarine cables are subject. One of the principal is that of a ship's anchor, and it was the disturbing element of a ship's anchor that prevented me from having the pleasure of being before you last Monday. On the table is a piece of cable which has been taken out of that crossing the River Humber. The cable which crosses this river is one of the most important that we possess, and for that reason one of the strongest kind of cable ever made was laid down. In the Postal Telegraph Department we have no less than 62 cables, and their aggregate length of 1,224 miles contains a total of 3,809 miles of wire. To cross rapid streams and important rivers strong cables are used, and to cross the Humber, which during spring tides runs at the rate of six to seven knots an hour, a cable of the strongest type was used; yet it had not been down six weeks when a ship got hold of it, and the cable was caught by its anchor. The heavily laden schooner riding on a strong tide, with its anchor attached to the cable, brought to bear an enormous force, and, perhaps owing to the construction of the cable, this force would not be equally divided among the outside protecting wires, and thus one wire, bearing the greater strain, gave way, followed by the snapping of a second, and so on till the whole cable was severed in the straggling and tangled manner that you see, which is very different from its symmetrical form when first laid. This break occurred in a very nasty stream, where the cable was so buried in mud that I could not find it; and I was despairing of being able to give even a second lecture here, when a happy thought occurred to me. I had spent a whole day in grappling after this cable, trying over and over again, and yet never getting near it, when it suddenly came into my mind that Shakespeare makes Bassanio say: "In my school days, when I had lost one shaft, I shot his fellow of the self-same flight, the self-same way, with more advised watch, to find the other forth; and, by adventuring both, I oft found both." So, knowing that a ship had dropped its anchor over the cable, I thought we would drop our anchor too, and we did, and waited a whole tide, and when we hauled the anchor up there was the cable.

The chief cause of accidents to cables, next to that of anchors, is probably due to abrasion of the cables on rocky bottoms. The bottom of the sea is frequently of an undulatory nature, and the cable remains suspended from point to point, and at such points the wire becomes chafed and worn away, and speedily decays. I am sorry to see that the time at my disposal has gone so rapidly that I cannot particularize to you many of the different causes that lead to the destruction of cables, not only abrasion, not only accidents in paying out, but accidents that exist afterward; for instance, a whale once caught a cable in the Persian Gulf and broke it; a shark's tooth has been found embedded in a cable, and a sinking ship has caused damage to a cable.

Sometimes the cables rest on corrosive stones, copper ores, and ironstone, when corrosion sets in and causes the cable to speedily fail. Volcanic action sometimes damages cables, as also rock slips. In the Bay of Biscay, which is crossed by the Direct Spanish Company's cable, there is no doubt that such a cause has interfered with the cable on two occasions, curiously enough, interrupting the wire each time on the same day of the year. There is a peculiar shelving of the rock, and slips exactly equivalent to our landslips take place at intervals.

Icebergs, too, from the North Atlantic, frequently carry large pieces of rock, which fall to the bottom when the iceberg thaws, and in their descent are liable to fall across a cable and damage it.

There are also faults due to imperfect joints, due to accidents that pass inspection during the process of manufacture, but which slowly develop themselves after submersion or lapse of time.

Lightning, earth currents, and things of that kind affect cables, but, nevertheless, the eye of the telegraph engineer is constantly watching these circumstances as they happen, and he tries to bring to bear upon them all the power and thought he possesses; and the result is that, by slow experience, the cable of the present day is very superior to that used in the early days, and the improvement has been equal to the advance, which, I hope I have been able to show you, has been made as regards the insulators and iron wire.

ENGINEERING INVENTIONS.

Mr. Alexander T. Wilson, of Fairfield, Ill., has patented a cheap and simple device for securing and connecting the ends of rails, by the use of which fish plates and nuts and bolts may be dispensed with, and the necessity of punching holes in the rails be obviated. It consists, essentially, of a doubly slotted block of iron or steel, the top of which conforms to the thread of a rail, and whose bottom is flush with the foot of the rail, and which may be set between the rail, so that their ends may be fixed in the slots and held fast.

Mr. Felix S. Prendergast, of Savannah, Ga., has patented an improved gauge for determining the distance apart of the rails of a railroad track. It is so constructed as to give the correct gauge distance, even when the gauge board may not be at right angles with the rails. It consists in a track gauge formed of a gauge board having a segment of a circle attached to it near one end, and a segment of a circle or equivalent knife edge attached to it near the other end.

Mr. Cornelius R. Van Ruyven, of Deventer, Netherlands, has patented a simple and efficient apparatus for regulating and correcting the position of switches, the apparatus being under the control of the engine driver, so that should the switch stand wrong it can be shifted from the engine. This invention is an improvement in the class of switches whose operation is controlled by the engineer or engine driver, the movable rails being shifted or adjusted in position by means of devices on the locomotive.

An improved machine for opening ditches to receive tiles has been patented by Mr. Guernsey Smith, of Rochester, Ill. It is simple in construction, convenient, reliable, and will remove the soil and deposit it at the side of the ditch, and leave the ditch in proper condition to receive the tiles.

The Immensity of the Stars.

We take from *Le Monde de la Science* the following interesting "Considerations on the Stars," by Professor J. Vinot:

"It is known that the stars are true suns, that some of them are larger than our own sun, and that around these enormous centers of heat and light revolve planets on which life certainly exists. Our sun is distant from us 38,000,000 leagues, but these stars are distant at least 500,000 times as far—a distance that in fact is incommensurable and unimaginable for us. Viewed with the unaided eye the stars and the planets look alike; that is, appear to have the same diameter. But, viewed through the telescope, while the planets are seen to possess clearly appreciable diameters, the stars are still only mere luminous points. The most powerful of existing telescopes, that of Melbourne, which magnifies 8,000 times, gives us an image of one of our planets possessing an apparent diameter of several degrees. Jupiter, for instance, which, seen with the naked eye, appears as a star of the first magnitude, with a diameter of 45" at the most, will in this telescope have its diameter multiplied 8,000 times, and will be seen as if it occupied in the heavens an angle of 100°. Meanwhile a star alongside of Jupiter, and which to the eye is as bright as that planet, will still be a simple dimensionless point. Nevertheless that star is thousands of times more voluminous than the planet!

"Divide the distance between us and a planet by 8,000, and you have for result a distance relatively very small; but divide by 8,000 the enormous number of leagues which represents the distance of a star, and there still remain a number of leagues too great to permit of the stars being seen by us in a perceptible form. In considering Jupiter, or any of the planets, we are filled with wonder at the thought that this little luminous point might hide not only all the visible stars, but a number 5,000 fold greater—for of stars visible to our eyes there are only about 5,000. All the stars of these many constellations, as the Great Bear, Cassiopeia, Orion, Andromeda, all the stars of the zodiac, even all the stars which are visible only from the earth's southern hemisphere, might be set in one plane, side by side, with no one overlapping another, even without the slightest contact between star and star, and yet they would occupy so small a space that, were it to be multiplied 5,000 fold, that space would be entirely covered by the disk of Jupiter, albeit that disk to us seems to be an inappreciable point."

Business and Personal.

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Park Benjamin's Expert Office, Box 1009, N. Y. Recipes and information on all industrial processes.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

To Capitalists, Steam Fitters, Founders, etc.—Patent right for sale of new Steam Heat Radiator. Address, for particulars, J. N. Farnham, Waltham, Mass.

Steam Traps; best and cheapest in use. No blowing through to start. T. Sault, New Haven, Conn.

Buzz Planers. P. Pryibil, 467 W. 40th St., N. Y.

Drawing Materials. G. S. Woolman, 116 Fulton St., N. Y.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

The Secret Key to Health.—The Science of Life, or Self-Preservation. 300 pages. Price, only $1. Contains fifty valuable prescriptions, either one of which is worth more than ten times the price of the book. Illustrated sample sent on receipt of 6 cents for postage. Address Dr. W. H. Parker, 4 Bulfinch St., Boston, Mass.

Brass or Iron Gears; list free. G. B. Grant, Boston.

The Friction Clutch that is doing work in many places satisfactorily, that has never been done by any other, can be seen at Institute Fair, New York. D. Frisbie & Co., New Haven, Conn.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

H. Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Steam Excavators. J. Souther & Co., 12 P.O. Sq. Boston.

Bradley's cushioned helve hammers. See illus. ad. p. 302.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y

Eagle Anvils, 9 cents per pound. Fully warranted.

Latest improved methods for working hard or soft metals, grinding long knives, tools, etc. Portable Chuck Jaws and Diamond Tools. Address American Twist Drill Co., Woonsocket, R. I.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Eclipse Portable Engine. See illustrated adv., p. 318.

Cylinders, all sizes, bored out in present positions. L. B. Flanders Machine Works, Philadelphia, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 30.

Linen Hose, Rubber Hose Steam Hose, and Hose for all purposes. Greene, Tweed & Co., 18 Park Place, N.Y.

Walrus Leather.—Wheels covered with walrus, and polishers' supplies of all kinds. Greene, Tweed & Co., New York.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with small capital. Send stamp for 80 page illustrated catalogue. McAllister, Manufacturing Optician, 49 Nassau St., New York.

Pat. Steam Hoisting Mach'y. See illus. adv., p 318.

Solid and Opening Die Bolt Cutters, Screw Plates, and Taps. The Pratt & Whitney Co., Hartford, Conn.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings, all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery. Send for descriptive catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Steam Engines, Automatic and Slide Valve; also Boilers. Woodbury, Booth & Pryor, Rochester, N. Y. See illustrated advertisement, page 285.

NEW BOOKS AND PUBLICATIONS.

AN ILLUSTRATED DICTIONARY OF SCIENTIFIC TERMS. By William Rossiter. New York: G. P. Putnam's Sons. 12mo, pp. 352. Price $1.75.

A handy book of reference, containing some 14,000 scientific terms, many of them not to be found in ordinary dictionaries. The list includes the more important technical and scientific words, and those most commonly used. In all cases the pronunciation is indicated, and usually the derivation. There have been added to the dictionary proper a number of tables of weights and measures, and briefly the nomenclature of botanical, zoological, anthropological, chemical, and geological classification. The illustrations are unimportant.

REPORTS TO THE ST. LOUIS MEDICAL SOCIETY ON YELLOW FEVER. By Wm. Hutson Ford, A.M., M.D. St. Louis: Geo. O. Rumbold & Co. 8vo, pp. 320.

Embraces the report of the committee appointed by the St. Louis Medical Society to inquire into the relations of the epidemic of 1878 to the city of St. Louis, and Dr. Ford's Report on the meteorological conditions and etiology of yellow fever, on the etiology of sunstroke, cholera, and other diseases associated with high temperature, and on the treatment of yellow fever. The volume is well indexed.

THE BUILDING MATERIALS OF OTAGO AND SOUTH NEW ZEALAND GENERALLY. By W. N. Blair. Dunedin, New Zealand: J. Wilkie & Co. pp. 244.

A volume of great local value and of considerable general interest, describing the building stones and roofing slates of New Zealand, their geology and outcroppings; the localities of the clay banks suitable for bricks, etc., and the qualities of such clays; New Zealand limes, cements, and their aggregates; and a very interesting review of the numerous timber trees and woods suitable for builders' use. There is added a section on the metallic products of Otago. The book is well indexed.

ELECTRO METALLURGY, PRACTICALLY TREATED. By Alexander Watt. New York: D. Van Nostrand. pp. 196.

This is the sixth and enlarged edition of Watt's handbook, from the English plates of 1876. A copious index has been added.

A SKETCH OF DICKINSON COLLEGE. By Chas. F. Himes, Ph.D. Harrisburg: Lane S. Hart.

An interesting history of one of the oldest colleges in the United States, neatly printed and illustrated by woodcuts and photographs. A particularly interesting chapter is that tracing the progress in scientific education since the founding of the college in 1783.

SEEING AND THINKING. By William Kingdom Clifford. London: Macmillan & Co. Price $1.

This, the latest volume of the *Nature* Series, includes four lectures by the late professor of applied mathematics and mechanics in University College, London, on the eye and the brain, the eye and seeing, the brain and thinking, and boundaries in general. No one who ever made an acquaintance with Mr. Clifford as a clear thinker and lucid expositor, need be told that, as an example of scientific teaching, this is one of the most valuable books of the series. In the death of Mr. Clifford the scientific world lost the most promising of its rising scholars; for he, more than any other, represented the ideal scientific intellect, at once earnest, fearless, and admirably sincere.

INDEX TO THE LITERATURE OF TITANIUM. 1783 to 1876. By Edward J. Hallock, 8vo, paper. pp. 76. Price 25 cents.

A paper read before the New York Lyceum of Natural History in 1876, and reprinted from the annals of the New York Academy of Sciences. Its plan is the same as that of Dr. Bolton's Indices to the Literature of Uranium and Manganese.

THE HORSE. By B. Pitcher. Second edition. Chicago: published for the author.

A short essay on the breeding, breaking, handling, shoeing, doctoring, and general treatment of the horse, by one who frankly declares himself to be no professor, college graduate, horse doctor, or doctor of any kind; but a humble mechanic. Mr. Pitcher is a practical smith of nearly forty years' experience and observation; and he treats his subject wholly from the practical standpoint. He has added a chapter of advice to young mechanics, in which he shows himself the possessor of no little practical wisdom and an abundance of sterling good sense.

FIRST STEP IN CHEMICAL PRINCIPLES. By Henry Leffmann, M.D. Philadelphia: Edward Stern & Co.

Designed to make clear by explanation and illustration those points in chemical theory, notation, and nomenclature which give trouble to beginners. Dr. Leffmann is the lecturer on toxicology at Jefferson Medical College, and his little handbook contains the substance of the lectures to the quiz classes of that institution.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) C. M. asks for a preparation to prevent nets from rotting in water. My nets are made of American hemp line, about ¼ inch in diameter, and therefore expensive. If I knew of some preparation or waterproof mixture that would prevent the water soaking into them and rotting them, it would be a great saving to me. A. The following treatment is said to preserve nets for a long time in good condition: Soften one lb. good glue in cold water, then dissolve it in ten gallons of hot soft water with one half lb. curd soap. Wash the nets in soft water, then boil them in this for 2 hours, press out excess of the liquid and hang up over night. The second bath consists of alum 2 lb., water, 5 gallons; heat nearly to boiling, and immerse the nets in this for about three hours, then press and transfer to a strong decoction of oak bark or a solution of sumac in warm water (water 5 gallons, sumac 8 lb.) and let them remain immersed in this for 48 hours, or longer, if convenient.

(2) R. G. B. asks for a method for electro-plating flowers. A. See pp. 380, (39), 47, and 34, Vol. 35.

(3) L. C. P. asks: 1. What is a good wash (red) for brick pathways? A. Try the following: red ocher, 5 lb.; water glass, ½ lb.; dissolve the latter in boiling water and add the ocher, to form a thin wash. Apply with a stiff brush, preferably while hot. 2. What is a good remedy to destroy ants in pantries, cellars, etc.? A. Try boracic acid powder.

(4) S. A. writes: I light my hotel with vapor of gasoline from a gas machine, and on the third floor and above it the light is much more brilliant and combustion more perfect with the same style of burners. Please explain the cause. A. In a column of air saturated with vapor of naphtha diffusion is never perfect, the heavier hydrocarbons tending to accumulate in the lower portions, and the combustion at these points is incomplete in ordinary burners, owing to the richness of the vapor in hydrocarbons.

(5) P. B. asks for a receipt for making a cheap imitation of mildew bronze. A. Dissolve equal weights of nitrate of iron and hyposulphite of soda in 8 parts of water; immerse the articles in this until of the right tint, then well wash with water, dry, and brush; 1 part chloride of iron and 2 parts water in parts to brass a fine antique green. Brush well and lacquer with pale gold lacquer, or polish with oil.

(6) G. writes: 1. On page 218 you publish an article on making cloth, etc., fireproof; would either the first, second, or third composition also tend to render the fabric mildew-proof; and if so, to what extent? A. Under ordinary circumstances the treatment would prevent mildew. 2. Would frequent wetting and rough usage be apt to wash or shake off the composition? A. Yes.

(7) N. C. M. asks for a recipe for making boots waterproof. A. Linseed oil, 1 part; mutton tallow, ¼ lb.; beeswax ½ lb.; melt and mix thoroughly together, and apply to the warm, dry leather with a brush. A small quantity of ivory black is sometimes added to this mixture.

(8) H. K. & W. M. W. ask (1) for a receipt for a size to mix bronze powder with so that it can be painted on with a brush (on iron gas fixtures, etc.). A. To one pint of methylated finish add 4 oz. of gum shellac and ½ oz. gum benzoin. Put the bottle in a warm place and agitate it occasionally. When the gums are dissolved, let it stand in a cool place 2 or 3 days to settle, pour off the clear portion and reserve for finest work, using the sediment, which by addition of more alcohol, may be made workable, when strained for first coat or coarser work. Add the bronze (*q. s.*) to this, and apply to the clean, smooth, warm iron, using a soft brush. Repeat, after drying, if necessary. Thin with alcohol (if necessary), to avoid wrinkles and brush marks. Varnish over all. 2. How is the glossy black obtained that I have seen on so many nice chandeliers? A. What you refer to is probably enamel or Japanese work.

(9) W. H. F. asks: 1. What kind of paper do stereotypers use for what is known as the paper process of stereotyping? A. First, soft sized cotton tissue paper; second, soft unsized printing paper of not too short fiber; backing, cartridge paper. 2. What is the paste made of that is used in the paper process of stereotyping? A. Good starch paste answers very well. 3. Is there such a machine known as an engraving machine, and by whom manufactured? A. Yes; several of these have been described and illustrated in the back numbers of the SCIENTIFIC AMERICAN. 4. Can terra alba (or white earth) be used in making moulds of plaster of Paris? A. It is occasionally used for fine castings, but not often.

(10) C. A. R. asks: 1. What is the value per ton of chromate of iron ore which assays 40 per cent oxide of chromium, delivered in New York or other Eastern cities? A. About $30 per ton. It would not be profitable to ship such an ore East. 2. Is there any cheap mode of extracting the chrome from the ore, which could be set up at the mine, to save transportation? A. The neutral chromate (yellow) and dichromate (red) of potassium, sodium, or calcium (lime), are the only preparations made direct from the ore. The chrome iron ore, previously pulverized and cleansed, is mixed with carbonate and nitrate of potassa, soda, or lime, as the case may be, and roasted on the hearth of a reverberatory furnace. The sintered mass after cooling is ground up, lixiviated with boiling water, silica, and alumina, precipitated from the solution by addition of wood vinegar (pyroligneous acid), and the clear liquid drawn off and evaporated until a film of saline material begins to form on the surface, when it is left to crystallize. From these crystals (yellow or neutral chromate of potassa or sodium), potassium (or sodium) dichromate is prepared by the addition to their solution of sulphuric or nitric acid; the dichromate crystallizes out on concentrating and cooling the solution.

(11) E. P. S. asks: Are there southern lights at the south pole, as there are northern lights at the north pole? A. Yes; Aurora Australis.

(12) C. J. D. asks (1) for a receipt for violin varnish (the best, if you please). A. Coarsely powdered gum copal and glass, each 4 oz.; alcohol, 64 o. p., 1 pint; camphor, ½ oz.; heat in a water bath with frequent stirring, so that the bubbles may be counted as they rise until solution is complete, and when cold decant the clear portion. When oil varnish is used it is made from artists' vinegar copal. 2. Receipts for stains for violins? A. To darken the wood rub over it nitric acid, specific gravity 1·2, and, after standing twelve hours, wash and dry thoroughly. Then use either of the following: First, prepare a groundwork with strong hot aqueous solution of logwood extract; then apply a solution of 3 oz. potash, 3 oz. red sanders; 2½ lb. gum shellac, and 1 gallon water, dissolved over a quick fire. 2. Boil 1 oz. logwood extract in 1 pint water (soft), and add 1-5 oz. cream of tartar. Use the stain hot, and give several coats, if necessary, drying between each. Use a "saw-edged" graining brush and asphaltum varnish, sufficiently thinned, to produce the proper markings.

(13) E. L. writes: We have tried a good many times, but without success, to melt the following metals, namely, ¼ oz. brass, 3 oz. pure silver, 1 oz. bismuth, 2 oz. common salt, 1 oz. of arsenic, and 1 oz. of potash. You will please let us know through your SCIENTIFIC AMERICAN what kind of crucible to be used, what kind of fire, whether it should all be put in the crucible at once, how to melt it, and when melted, whether to use plaster of Paris or brass moulds? A. You can use a French clay melting pot (crucible). Melt the brass and silver first under a layer of charcoal, then add your fluxes and finally the bismuth and arsenic wrapped in paper; after which pour as soon as possible, with care to avoid inhaling the poisonous arsenical fumes. With good management a four ounce charge may be fused in a good ordinary stove. For larger charges a regular crucible furnace will be required. You can mould in plaster of Paris. See "Hints to correspondents," above.

(14) S. A. F.—The following is a good composition for blackboards: Shellac, 8 oz.; alcohol, 1½ pints; warm the latter and digest in it the shellac until solution is effected. Then strain through a cloth, filter, and introduce about 5 ounces of a mixture of equal parts bone black (floured) and emery flour, stirring until a uniform distribution of these is secured. The mixture should have the consistency of very thin sirup. Thin with more alcohol, if necessary, and apply two coats, using a soft smooth edged brush.

(15) H. M. Co. ask: How can we in an inexpensive manner get the tin, solder, and dirt off old copper bottoms so as to make them clean? A. Cleanse first in a boiling solution of 3 parts caustic soda, 1 part niter, and 5 parts water, and then in dilute sulphuric acid; or dip momentarily in warm nitric acid, specific gravity 1·2, and wash immediately in running water.

(16) H. L. W. asks: To what extent is air compressible? Or what is the limit of the compressibility of air? A. We do not know that the limit of compressibility has ever yet been ascertained.

(17) C. K. asks: Which chain has the most strength, one with ¾ twist links, or one with ¾ straight links? A. One with straight links, because the stress is in the direct line of the link, which is not the case with the twisted link.

(18) C. N. K. asks if there is any way of finding the number of pounds of coal that is necessary to run 1 horse power when you have the following given: 1. The sum of the horse power of each machine. 2. The number of hours that each machine has run. 3. The total number of pounds of coal consumed. Is there any different way of arriving at the same thing? My object is to find out, after using several kinds of coal, which is the cheapest. A. 1 horse power has been produced by the combustion of 2 lb. of coal per hour; on the other hand, with badly designed engines and boilers, 8 or 9 lb. of coal per hour have been consumed to produce the same result; the quality of the coal affects the economy. The only way to get at the result you wish, is to weigh the coal consumed in a given time, and measure the water evaporated.

(19) W. H. G. asks how a cord of 4 foot wood should be piled up. One says that the sticks should be laid straight, with the bark side down, when they have bark only on one side; another, that it should be laid straight, rather carelessly, the pile to be 4 feet high and 8 feet wide; while a third claims that in New York and Philadelphia the practice is 128 cubic feet solid timber, arrived at by water displacement. A. 128 cubic feet as piled is one cord. The seller wishes to pile as open as possible, by so piling as to have the angles come in contact; the buyer, on the contrary, wishes to pile as close as possible, by fitting the angles into each other.

(20) W. H. B. asks: Which quality of iron, hard, coarse, and granular, or fine, soft, and close grained, will best stand the heat of anthracite coal under steam boilers, grate use? A. We think a mottled gray iron with large crystals is the best for the purpose.

(21) E. S. F. asks if a boiler 16 inches diameter, 4 feet high, with the sides and ends of wrought iron 3-16 of an inch thick, will hold 50 lb. pressure with perfect safety. A. 3-16 will do for the sides, but the ends, if made 3-16, should have a brace tying the two ends together.

(22) W. T. writes: 1. I have an upright engine of six inch bore and 12 inch stroke (6 inch by 12 inch), ports 3⅛ inch by ¼ inch, exhaust 3⅛ inch by 1 inch. I am told that it is designed to run at 100 to 125 turns per minute. Now with this engine how can I run a boat about 32 feet long, of less than 5 tons measurement (500 cubic feet), with side wheels, stern wheel, or propeller, using steam at 100 to 125 lb. in boiler, no cut-off, at the rate of 10 miles per hour for a several hours' trip? A. You can do it by using a propeller, if you have ample boiler. 2. Is there any kind of side wheels that could be run advantageously at 125 turns per minute? A. No 3. Is it practicable to run such a boat, weighing with contents 4 tons, with such an engine, with side wheels, at ten miles per hour? A. No. 4. Would friction pulleys work as well as gearing? A. You need no gearing for a propeller.

(23) W. W. writes: I have a small boiler, 5 feet in length and 13 inches diameter, with 18 one-inch tubes. I have laid it down, and the fire box, of brick, is 9 by 18 inches, and the bridge wall is 3 inches from the boiler, and is continued that way all the way to the end of the boiler, where a space of 9 inches is left. The space under the grate is 1 foot, and the smoke pipe is 8 inches. The fire goes under the boiler and returns through the tubes. I have put the exhaust into the pipe, but can get no draught. What is the trouble? A. The trouble is in the small area of the tubes; set your grate out in front of the boiler, with 2½ inches depth of fine under the boiler; let the fire pass both through the tubes and under the boiler direct to the chimney.

(24) F. W. R. asks how to obtain a column of air having a velocity of twenty-five thousand feet per minute (25,000 feet); the opening or nozzle to be one inch. Could I use an air pump, forcing the air into a chest or box, and then use at will, from one inch openings? A. The only way is to compress the air by an air pump to the pressure necessary to give the required velocity.

(25) J. D. R. asks how to make a paint or blacking for a boiler. The boiler is in the house, and something that makes as little smell and smoke as possible, is desirable. A. Use asphaltum varnish. There is little or no odor from it when dry.

(26) J. C. asks: On an engine with cylinder 5 inches diameter and 4 inch stroke, running at 200 revolutions per minute, with an average steam pressure of 50 lb. per square inch, what size pulley should be used to drive woodworking machinery, said pulley to be used both as pulley and balance wheel? A. Probably a pulley 4½ inch face; the diameter must be determined by the speed required for your line shaft.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

October 21, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Areator and refrigerator for beer and other liquids, C. P. Blatt 220,705
Agate and other stones, bleaching, coloring, and ornamenting, A. Dreher 220,708
Aluminous cake, making, F. Laur 220,730
Anvil and vise, combined, G. B. St. John 220,886
Axle box, car, T. A. Bissell (r) 8,940
Bale tie, W. H. Boane 220,869
Baling press, Cagle & Nichols 220,802
Baling press, W. L. Morris 220,859
Beehive, D. P. Bower 220,747
Beer, apparatus for filling out, J. & J. Stuber 220,888
Beer, extracting malt in making, J. A. Schaefer 220,872
Blasting squib, Thomas & Powell 220,735
Boat lowering apparatus, H. Bruns 220,798
Boot and shoe button hole, B. L. Newhall 220,860
Boot and shoe former, Walker & McIntyre 220,775
Boot and shoe sole edge finisher, E. Humphrey 220,841
Boot, rubber, G. Watkinson 220,778
Bootee, J. F. Emerson 220,710
Bracket, J. J Read 220,730
Bung and bushing, J. A. Rutschman 220,871
Bung and stopper for casks, W. H. Stewart 220,773
Button, dress, R. E. Brookes 220,697
Can cover, J. H. Hettinger 220,825
Candlestick, A. J. Smith 220,879
Car coupling, Bradley & Sherratt 220,797
Car coupling, Cook & Leas 220,899
Car coupling, F. C. Doolittle 220,814
Car coupling, S. Garratt 220,713
Car coupling, Harlin & Byram 220,830
Car coupling, J. H. Horton 220,716
Car coupling, P. Y. Kepler 220,719
Car warmer, street, I. S. Justh 220,718
Car window, W. J. Hall 220,756
Carburetor, J. H. Bean 220,695
Carding machine, T. Kershaw 220,905
Carriage springs, machine for forming the eyes of, J. Evans 220,711
Carriages, reversible handle for childrens', F. Meinecke 220,721
Cartridge capping and uncapping implement, G. L. Bailey 220,743
Cartridge turning implement, W. G. Rawbone 220,771
Catarrh remedy, H. E. Bissell 220,794
Centrifugal machine, Gaunt & Polesz 220,824
Churn, S. Collins 220,750
Clay or cement to make the joints of stoves and fireplaces, fire, J. Hinklein 220,715
Clock and watch, J. A. Miller 220,724
Clothes line reel, P. E. Bird 220,795
Clothes wringer, G. S. Foos 220,821
Coffee and rice huller, C. B. Brown 220,698
Coffee pot, J. D. Adney 220,691
Coin holder, L. H. Olmstead 220,770
Collar and hame attachment, A. Carlin 220,804
Concrete pipe, apparatus for making and laying continuous, Hamilton & Earl 220,797
Copper lined boiler, W. L. Brownell 220,748
Corn stub cutter and splitter, S. Sherman 220,877
Corset, abdominal, J. C. Cook 220,806
Cotton gin, J. F. Means 220,854
Cotton gin, F. E. Smith 220,880
Cotton scraper, L. W. Carraway 220,700
Cradle, platform, F. Mohr 220,857
Cupel furnace, S. G. Wight 220,895
Curtain fixture, J. W. Core 220,807
Curtain roller and bracket, Barrett & Knapp 220,737
Curtain roller, spring, T. Barrett 220,796
Dental engine, J. Heron 220,834
Door brace, J. Louprette 220,852
Dredge winder, C. C. Green 220,827
Electric recorder, P. A. Dowd 220,752
Elevator, P. Hinkle 220,758
Elevators, governor and safety appliance for, G. Dryden 220,709
Eyeglasses, nose clamp for, F. Perrin 220,864
Fence, barbed wire, J. H. Weaver 220,740
Fence, rail, B. A. Welds 220,892
Fence, wire, L. W. Bosart 220,746
Fire alarm telegraph box, non-interfering, A. W. Gray 220,754
Firearm lock, A. E. Barthel 220,785
Firearm, magazine, Sweeney & Wetmore 220,734
Fire escape, O. H. Curtis 220,703
Fire extinguisher, automatic, E. Leonard 220,764
Fireplace, open, E. A. Jackson 220,843
Fishing reel, S. W. Wardwell, Jr 220,776
Furnace feeder, automatic, Dillon & Scully 220,901
Fuse for shells, time and distance, H. Berdan 220,792
Garter, W. W. Anderson 220,692
Gas burner, O. Tirrill 220,736
Gas lighting device, electric, W. C. Cutler 220,704
Glider's press, J. T. Shepperd 220,875
Glassware, manufacture of, H. Franz 220,822
Governor and speed regulator, engine, J. Reid 220,867
Governor, steam engine, A. Lawrence (r) 8,937
Grain meter, J. Nurnberger 220,861
Grater and cutter, vegetable, W. Mild 220,723
Grave shield and body protector, S. S. Smick (r) 8,941
Harness pad, adjustable, J. Johnson 220,846
Harvester pitman, D. S. Blue 220,696
Hat finishing machine, J. Surerus 220,774
Hat pouncing machine, E. B. Taylor 220,889
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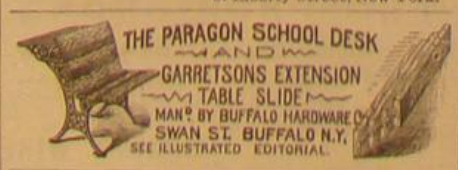

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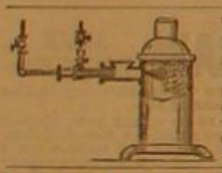

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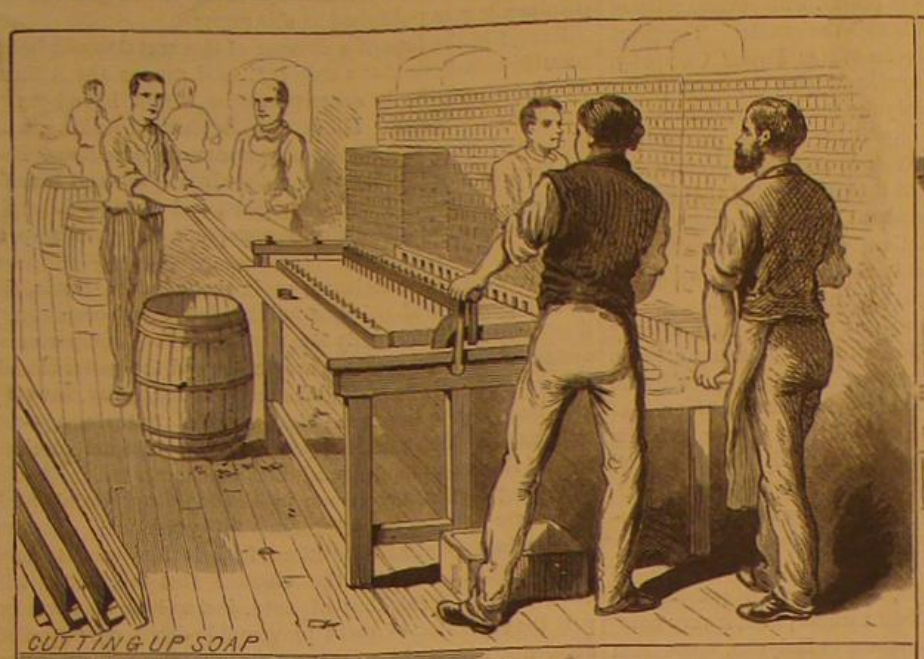
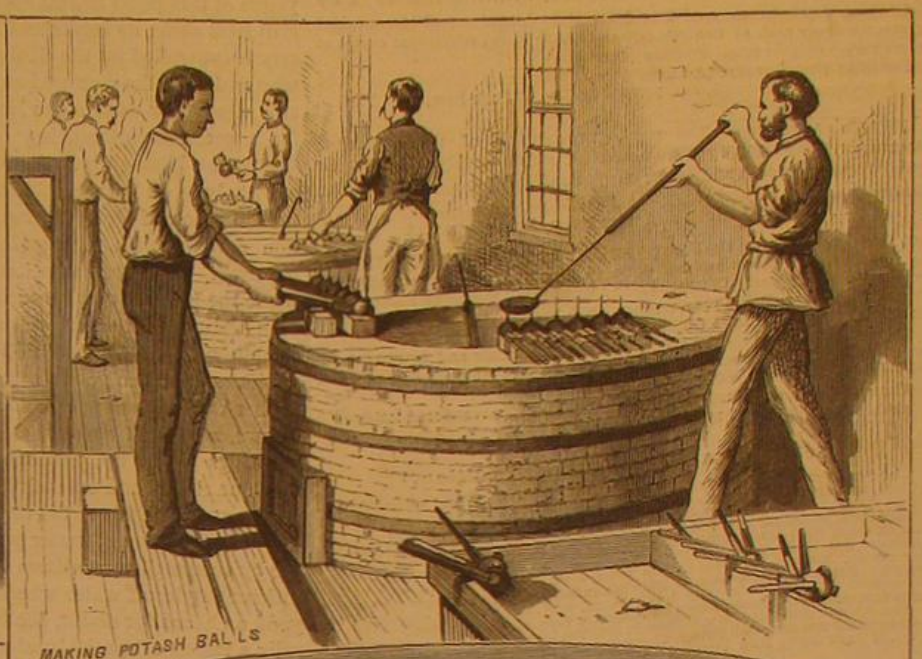


CUTTING UP SOAP



MAKING POTASH BALLS

PRESSING SOAP INTO CAKES

THE LARGE KETTLE

WEIGHING & PACKING SALARATUS

BABBITT'S EXTENSIVE SOAP MANUFACTURING WORKS.—[See page 340.]

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NEW YORK, SATURDAY, NOVEMBER 29, 1879.

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Compound Three-cylinder Engine of Steamship Orient. 1 large engraving.
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Cost of Railway Cars.
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II. ELECTRICITY, MAGNETISM, LIGHT.—M. Jamin's Electric Lamp. 5 engravings.
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Progress of Industrial Chemistry. By J. W. MALLET. Brief review of the most important changes in the industrial applications within the last few years.
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THE HOLYOKE TURBINE TESTS.

One of the finest illustrations of the results of New England thrift and energy is to be found in the city of Holyoke, Mass., the great center of paper manufacture in this country—probably the greatest in the world. The city lies in a bend of the Connecticut River, below the Great Rapids, and is growing with astonishing rapidity in consequence of the unrivaled facilities the place affords for manufacturing enterprises, due to its magnificent, unfailing, and economical water power.

A dam, 1,019 feet long, 130 feet wide, and 30 feet high above the bed of the river, throws the vast volume of the Connecticut into a series of canals lying at three levels, with a total fall of 56 feet. Thus harnessed, the Connecticut yields at this point 30,000 horse power, with several miles of mill sites along its banks and beside the canals. The property is controlled by the Holyoke Water Power Company, who maintain the dam and canal, and lease the water power at a rate so low as to make Holyoke the most promising site for a great manufacturing city using water power this side of the Mississippi. As evidence that these promises are not likely to go long unfulfilled it may be noted that in 1861 the valuation of Holyoke was about two and a quarter million dollars, with a population of eight thousand five hundred. Now the valuation is about ten million dollars, while the population approaches twenty thousand.

In addition to the numerous paper mills there are already established many thread mills, cotton mills, manufactories of silk and woolen goods, extensive machine shops, cutleries, rubber works, besides establishments for the manufacture of screws, wire, and so on. On all sides the visitor sees new buildings going up, particularly new mills, factories, and machine shops, and extensive additions to old ones.

The general basis of the city's growth and prosperity being the utilization of water power, the importance of deciding by thorough competitive tests the relative values of the different styles of water wheels, to establish, if possible beyond a chance for doubt, the best turbine plans, is very naturally a matter of special local interest in Holyoke, apart from the great importance of such tests to all water power users throughout the country. Accordingly the city authorities united last spring with the Water Power Company in an invitation to water power companies, cities that pump their water supply, and all others interested in the matter, to take part in a series of tests of water wheels, at the expense of the Holyoke Water Power Company, with special invitations to the Locks and Canals Company, of Lowell, Mass., the city of Philadelphia, the National Millers' Association, the American Society of Civil Engineers, and the representatives of the owners of the turbines furnished, to send accredited engineers, as guests of the city, to witness and take part in the trials.

These tests have been in progress during the past two months at the testing flume of the Holyoke Water Power Company, which had been enlarged and put in excellent condition for the purpose, making it the most perfect flume of the kind ever constructed. The apparatus used in testing the wheels and the methods employed are those of Mr James Emerson, whose tests at the same flume during recent years have done so much to determine the actual practical efficiency of the different styles of water wheels.

In the course of a month or so the reports of the testing and supervising engineers covering the whole series of tests will be officially promulgated, and will promptly appear in the SCIENTIFIC AMERICAN. In the meantime we shall begin a series of special reports of the tests of the more important wheels, with full details, and a more particular description of the methods, apparatus, and conditions of the tests than is possible at this time.

COLLISIONS AT SEA.

On Friday, November 7, occurred two remarkable collisions at sea, one between the coasting steamer Champion, of the New York and Charleston line, and the English ship Lady Octavia, off the Delaware Cape, resulting in a heavy loss of life; the other between the Arizona, of the Guion line, and an iceberg, while crossing the northern edge of the Newfoundland Banks, no lives being lost. On the following day another steamer, the Falcon, plying between Baltimore and Charleston, was run into by a large three masted schooner laden with ice, and quickly sank, the passengers and crew escaping in life-boats.

These three collisions, occurring almost simultaneously, give terrible emphasis to the ever-imminent risk of such disasters, and the vital importance not only of keeping a good look-out at sea, but of the need of improvements in ship-construction which shall make all vessels practically unsinkable.

The Champion was an iron steamship, 234 feet long, 31 feet beam, and 18 feet in depth of hold. She was built in four compartments, and was lightly laden; yet she filled and sank within five minutes after striking the Octavia. The Lady Octavia was slightly smaller, but much more substantially built. She was one of the first sailing vessels built exclusively of iron, and her plates were much thicker than those now used in shipbuilding. She was struck abaft the stern on the port side, smashing her bows and cutting two great holes in her side, one of them three feet under the water line. The fore compartments filled almost instantly, the watertight bulkhead alone saving the vessel from foundering. Four passengers and twenty of the Champion's crew were picked up, the most of them having clung to floating fragments, or taken refuge on a life raft and in one of the boats which broke away as the steamer was sinking.

The disaster was due wholly to the absence of a proper look-out on board the steamer. The night was clear, the moon was shining brightly, and the captain of the Octavia reports that the Champion was in sight ten minutes before the collision occurred.

The Arizona's mishap was equally inexcusable. With a clear sky and a smooth sea the ship was run head on against a huge iceberg, while going at a rate of fifteen knots an hour. Her entire bow was literally smashed, but fortunately the collision bulkhead was staunch and the vessel was saved. It will be remembered that the Arizona was launched only last spring, when a full description of her magnificent appointments was published in this paper.

Except in the face of a disaster of this sort it would be impossible to believe that a ship built and run as the Arizona was for superiority in every particular, could have been so recklessly navigated. Her escape from instant sinking, with the loss of every one on board, was almost miraculous. Had the blow been a quartering one, the ripping open of her side would have been all but inevitable, and we should simply have had to record another disappearance of a great ship at sea.

In the case of the Arizona, as in that of the Octavia, the vital importance of collision bulkheads is most impressively illustrated; and indirectly also the value of the compartment system when the partitions are strong and the ports closed. They are not all the conditions requisite for safety, but they go a long way to lessen the risks incident to seafaring—not the least of which would appear to be the criminal carelessness of ship commanders and their assistants.

So long as men, even those in the most responsible positions, are liable to relaxations of vigilance; so long as men in subordinate positions find it less easy to take trouble than to take the chances that no harm will come from their shirking of duty, just so long may we expect the repetition of those preventable disasters, miscalled accidents, which add so many needless terrors to seagoing. For an endless variety of reasons that are no reasons, look outs will fail to look out, and collisions will occur after every provision has been made for preventing them by the use of electric lights, sound-signals, and other contrivances. All these are useful and desirable, no ship should go to sea without them; no officer should be retained who neglects them. But more than these is necessary. The ships themselves must be made with such elements of buoyancy that they will not sink under any probable condition of things at sea. With the enormous actual and prospective increase in shipping, particularly in the department of passenger traffic, the heavy annual losses by shipwreck, and the increasing thousands always at sea and subject to its dangers, the need of unsinkable ships must every year grow more and more urgent. There is no field in which the inventor can more directly contribute to the welfare of men than in this; nor is there any which holds out more generous promises of reward to the men who shall solve the problem involved. The closing years of this century are likely to see as grand an advance in the scope and magnitude of American commerce as recent years have shown in the advancement of agriculture and the mechanic arts. It lies with our inventors to determine whether the commerce of the future shall be secure as well as great.

THE AMERICAN PUBLIC HEALTH ASSOCIATION.

The seventh annual meeting of the American Public Health Association will be held in Nashville, Tenn., November 18 to 21. The principal subjects for discussion will be the sanitary condition of cities and towns, especially those of the Southern States, and the proper treatment of actual or threatened outbreaks of yellow fever. Under the former head will come subjects relating to water supply, drainage and sewerage, disposal of garbage and excreta, slaughter-houses and abattoirs, public school-houses, public health laws, regulations, etc., expenses of municipal sanitation, and the like. In the discussion of yellow fever the following points will be specially considered.

1. How to deal with a city in the yellow fever zone in order to prevent the appearance of a first case. 2. How to prevent the importation of a first case. 3. How to deal with a first case and early cases generally when, in spite of precautions under first and second headings, it has made its appearance. 4. The duty of local boards of health, or other health authorities, to report such cases promptly, even though there may be some doubt as to the diagnosis. Whether the knowledge that such reports would be faithfully made would not have a tendency to allay apprehensions, and give confidence to other communities while warning them of the importance of making preparations for contingencies. 5. Under what circumstances may it become necessary or expedient to remove the unacclimated portion of the population from an infected place? How may this be effected for the poorer classes of the population, and how should the people thus removed be cared for and supported? 6. Measures for isolating a dangerously infected place. 7. Organizations for the relief and treatment of the sick in an infected city. 8. Measures for preventing the spread of the disease from an infected place by railroads, including the management of transfer stations. 9. Inspection of steamboats at an infected place and at intermediate stations between the port of departure and their final destination. Should stations of observation be established by the National Board of Health? If so, what should be their relations to the health authorities of the

States within whose territorial limits they may be established? 10. Results of the co-operation and aid given by the National Board of Health to State and municipal boards under the provisions of the act approved June 2, 1879. What suggestions may be made to render this system more efficient?

During the sessions of the association the National Board of Health will be officially convened. On the 22d the Sanitary Council of the Mississippi Valley will convene, and on the 19th a conference of railway and steamboat managers will consider questions relative to rules and regulations calculated to arrest the spread of infectious diseases through the movement of passengers and freight. On the 17th the Medical Society of Tennessee will meet in special session, and will act as committee of reception. The State Board of Health, the Nashville Board of Health, and the Citizens' Auxiliary Sanitary Association will also contribute to the membership of the committee.

THE USE OF STEEL FOR BRIDGES.

The adaptability of steel as a material for bridges has become a prominent topic of discussion among engineers and bridge builders. In view of the frequency with which pieces of steel of a guaranteed high tensile strength and superior quality have unexpectedly broken, and this in positions that iron has filled much better, has naturally made many engineers skeptical upon the propriety of using it in bridge construction. On the other hand, there are some who are sanguine enough to believe that all that is now necessary, in reference to the introduction of this material, is merely to proceed to use it. The problem, however, is not a simple one; and there are several difficulties to be surmounted, one of the greatest being the want of uniformity of production, the homogeneity of the material. It seems to be understood that high carbon steel, made at the same works from the same materials, differs materially, day by day, in its strength and elasticity, and as a sample out of every bar cannot well be tested, there can be no certainty of just what strength the bridge will possess when the various bars are placed side by side.

Some of the facts that would seem to govern the successful introduction of steel for bridge construction have recently been given in a paper read by Mr. Theodore Cooper before the American Society of Civil Engineers. Mr. Cooper insists on the fact that the engineer who proposes to use steel should not attempt to specify to the manufacturer either its chemical constituents or its manipulation, but should chiefly concern himself with the physical characteristics that the material should possess to best perform its desired work. The most important of these are the tensile strength and elasticity, and which largely represent its suitableness for engineering purposes. The fact is well known that great ductility is accompanied by a low tensile resistance, and *vice versa*. The author points out the importance of requiring a ductile metal regardless of what its tensile strength may be, this ductility to be that of the actual rolled material, and not that of the ingot metal, or samples of the latter worked in a different manner from the material to be used. The amount of tensile strength that can be obtained in connection with a specified percentage of elongation is dependent upon two factors. The first of these, the chemical composition, is only of importance to the user of the material, as it may impart new physical attributes; but even with a knowledge of its accurate composition he is still compelled to depend upon his physical tests to be assured of its quality. The second factor, or amount of work put upon the metal, will be governed by the capacity of the plant by which it is to be worked. Therefore, so large a tensile strength cannot be expected in the heavy sections as in the smaller ones. Competition will soon develop the capabilities of our manufacturers of steel, when a sufficient demand has been created for a steel with definite characteristics suitable for bridge purposes. The following requirements for bridge steel should, in the author's opinion, be the *maximum* as to tensile strength, and *minimum* as to elongation demanded, until increased experience proves the safety of changing them: For plates, angles, channels, and other shapes, an ultimate strength between 65,000 and 70,000 per square inch; elongation not less than 20 per cent in 8 inches; limit of elasticity above 35,000 pounds per square inch. For small bars and rods, an ultimate resistance between 75,000 and 80,000; elongation not less than 20 per cent in 8 inches; limit of elasticity above 40,000 pounds per square inch. For large flat bars, an ultimate resistance between 70,000 and 80,000; elongation not less than 15 per cent in 8 inches; limit of elasticity above 38,000 pounds per square inch. In addition, the steel must be satisfactory as to its hardening tendency, bending tests, etc., with such other practical conditions as may insure a certain and reliable material for the required purpose. He would not deem it advisable to increase the customary working strains used for iron bridges more than 50 per cent. As to the kind of steel, as regards make, that will prove most suitable for bridges, the question must be decided by the relative cost of such material as will fill the requirement; and the latter can undoubtedly be filled by either the crucible, Bessemer, and open hearth processes. The additional cost of smelting would apparently rule out crucible steel, leaving the competition between the two latter processes. Mr. Cooper's paper does not definitely indicate what economy and what advantages may be expected to result in bridge construction from the substitution of steel for iron; but it is, perhaps, impossible to reach any very positive conclusions at present in regard to these matters, owing to the absence of information as to the adaptability and homogeneity of the material. The attitude of engineers on the subject of steel for bridges appears to be one of expectancy, and they seem inclined to put the burden of the proof on the manufacturers, and to require them to furnish evidence of its adaptability and economy before they will consent to use it.

EDISON'S ELECTRIC GENERATOR.

To the Editor of the Scientific American:

A communication in No. 20, page 305, of this volume of your paper, headed "Edison's Electrical Generator," requires a few words of explanation.

Special pains are there taken to imply that the writer of an article on this machine in No. 18 either had been deceived or was trying to deceive others by statements which were made regarding the machine. The writer of the account simply stated that the machine was so constructed that when used at its normal capacity the external resistance should be nine times as great as the internal, so that ninety per cent of the power in the current could be used outside. No fuller statement was made, since Mr. Edison preferred to wait until he had made some improvements that his experiments had shown were necessary. Yet all that was claimed in the article was perfectly true, and has been carefully verified.

The statement that one man could maintain the arc of a Jablochkoff candle was made after trial. It was found by careful tests with a Prony dynamometer that a man could exert for a short time about one-half a horse power, and that for the same time he could maintain an arc equal to that from a Jablochkoff candle. This test was made for the purpose of showing beyond all question that the power requisite for a good light need not be very great.

In illustrating the action of electricity in the circuit, Dr. Seeley wisely remarks and kindly explains how that "beasts of burden and other rational creatures redouble their efforts when their burdens are increased, while electricity behaves very differently, as there are no moral suasions or reserved forces behind it." Yet the learned doctor of philosophy, in saying this, reminds one of the bright scholar he mentions, "whose vision, though very clear, is not so wide, who is quick to spy out a thing, yet does not observe its environments." It seems never to have occurred to the doctor that it is in the power of the maker of the machine to exert this "moral suasion" on the wire covering the armature, so that it shall be more effective and redouble its exertions when greater resistance is offered for it to overcome.

Suppose, for example, a machine was made so as to run on short circuit having one unit of resistance within the machine from, which was given off a certain amount of energy. If the wire on the armature could be made four times as efficient, three units of resistance could be placed outside, and yet each unit would give off the same energy as did the one in the machine in the first case. If the wire could be made nine times as efficient nine times the resistance could be placed in the circuit and still have each unit as active as in the first case. Mr. Edison, by using large magnets, has done this; that is all he claimed, and all that the writer of the article which provoked this discussion expressed. He was perfectly aware of the fact that the friction of the machine and local action counted more in proportion as the resistance in the circuit was increased. Yet he felt contented so long as the tests which I made for him showed that less was lost than in any other machine in transferring mechanical into electrical energy. His machine is so made that it would be impossible to use it with the same resistance outside as inside, as it would heat the wire on the armature so as almost to burn it, by carrying a current so much in excess of that for which it was intended.

The reader, whom Dr. Seeley advises so glibly to wrestle with Ohm's law until he has mastered it, may when he begins take the doctor as a pupil and show him that he has wrongly applied the simplest equation, expressing it $C = E R^{-1}$. "I am grieved to observe that many people who talk and write glibly about electricity do not understand it," and no better illustration can be found than in a doctor of philosophy deliberately stating that current and foot pounds are the same, or that energy is directly proportional to the current. Foot pounds are always measured by the square of the current, and the method of measuring is analogous to that employed for measuring the energy in a stream of water. For if twice the amount of water flows from a given sized jet against a turbine, it will be able to do four times the work, for each particle of water will be moving twice as fast and thus be twice as energetic, and there will be two times as many of them. Although Dr. Seeley has used the water analogy he has failed to see its "environment."

Dr. Seeley's distinction of outside from inside current seems to me ridiculous, for it is exactly similar to saying that an endless wire rope running from a building out of doors has an outside and an inside velocity. The current means the rate of flow of electricity, and must be the same for the whole circuit, so that the "outside and inside currents" must always be the same.

In conclusion, I may state that the methods which are employed for testing Mr. Edison's machines were fully described in a paper read by me at the Saratoga meeting of the American Association. At that time, as now, full results were withheld until Mr. Edison was fully satisfied with the performance of his machine.

To show the line of experimenting he has chosen, it may be mentioned that he hopes soon to have a machine with only one-eighth of an ohm in the armature, which he will use with an external resistance twenty times as great, and which shall give with less than one-tenth of a horse power on the magnets an electromotive force of 100 volts.

FRANCIS R. UPTON.

Laboratory of T. A. Edison,
Menlo Park, N. J., Nov. 11, 1879.

HOW FAR CAN WE HEAR WITH THE TELEPHONE?

This is a question frequently asked, but we believe has not yet been definitely settled. The longest distance that we have seen mentioned is given in the item below, namely, two thousand miles. But perhaps Mr. Edison has had more extended experiences. If so we should be glad if he would let our readers know.

An exchange states that Mr. Robert A. Packer, superintendent of the Pennsylvania Railroad, is at present hunting with a party of gentlemen in Nebraska. A few days ago he for two hours conversed pleasantly with his wife and friends at Sayre, Pa., his brother at Mauch Chunk, Pa., and friends along the line. The medium was the railroad and Western Union Telegraph wires and Edison's telephone. At the office in Bethlehem, Pa., connection was made with the Easton and Amboy wire, and at Perth Amboy with a Western Union wire, and thence to Chicago and North Bend, Nebraska, where the party are. The distance was about two thousand miles, and every whisper was audible.

Professor Proctor's Lectures.

In the first two of his series of lectures on astronomy, at Chickering Hall, Prof. R. A. Proctor has amply sustained the favorable impression made both by his previous lectures here and by his numerous writings. His manner is pleasing, and he has a happy faculty for incorporating in his lectures the latest and most interesting of astronomical observations, deductions, and theories. In his first lecture, Nov. 10, he dwelt upon the beauty and glory of the heavens, the subject as announced being the poetry of astronomy. The second lecture—Nov. 13, on the immensity of space—gave opportunity for a very interesting and instructive review of the dimensions and characteristics of the solar system, the transit of Venus, and the evidence it afforded as to the distance of the sun, and the dimensions of the members of the solar system, cometic theories, the milky way, star distances, and other aspects of astronomical observation and speculation. The third lecture will be on the vastness of time as revealed by astronomy; and the last will treat of other worlds and other suns. The excellent stereopticon illustrations accompanying these lectures add materially to their value and interest.

Crude Petroleum as a Remedy in Consumption.

Dr. M. M. Griffith, of Bradford, Pa., reports some astonishing results obtained by the administration of crude petroleum to consumptives. He claims that out of twenty-five cases of well marked tuberculosis so treated twenty are to all means of diagnosis cured; the rest have been materially benefited; and none have been under treatment more than four months. The nausea attending the use of ordinary crude petroleum led him to adopt the semi-solid oil that forms on the casing and tubing of wells. This, made into three to five grain pills by incorporating any inert vegetable powder, was administered from three to five times a day in one pill doses. The first effect, he says, is the disappearance of the cough; night sweats are relieved, appetite improves, and weight is rapidly gained.

It is to be hoped that Dr. Griffith has not mistaken some self-limiting phase of throat or bronchial disorder for true consumption of the lungs; also that continued trial of the alleged remedy will justify the high opinion he has formed in regard to its efficacy.

The Highest Inhabited Houses in the World.

In this country, a miner's house on Mount Lincoln, Colorado, is 14,157 feet high. In Peru, a railway village, called Galera, is 15,645 feet high. Near this place is the celebrated railway tunnel of La Cima, which is being bored through the peak of the mountain. The tunnel is 3,847 feet long, and is located 600 feet above the line of perpetual snow.

A Proposed Offer of $10,000 Reward.

With reference to ginning and spinning in the Southern States, a resolution was lately adopted by the State Agricultural Society and Grange, of Chester, N. C., to ask the State Legislature for a reward of $10,000, to be paid for an invention which will enable farmers, upon their plantations and at paying rates, to convert their crops from the seed into yarns.

The principal object in view is to direct the attention of farmers and inventors to the want of such a machine, as well as to the practicability of perfecting it. Such machines can be had even now, but they are too costly and large for farm use, and this it is desired to remedy.

THE British Consul at Panama reports that India-rubber has almost ceased to be an article of export from the isthmus, mainly in consequence of the great difficulty and expense of getting at the trees in the remote districts of the interior. Those nearer the coast have been destroyed by the wasteful system pursued by the natives in cutting down the trees to procure the sap.

A NEW VELOCIPEDE.

We give herewith an engraving of a new velocipede recently patented by Mr. S P. Ruggles, of 1209 Washington street, Boston, Mass. It is designed especially for the use of young girls and misses as a means of out-door exercise and amusement, and for developing the muscles of the lower limbs, and in fact of the entire body.

The velocipede is provided with two seats, one for the operator and the other for the passenger. These seats, which resemble a part of an ordinary cane chair, are mounted, one in front of the other, on a frame that is supported at the rear by a caster wheel, and in front by the axle of the drive wheels. Below the axle there are two levers or pedals, which are pivoted to the main frame below the rear seat, and are provided with stirrups for receiving the feet of the operator.

Two cranks, formed in the main axle diametrically opposite each other, are provided with thimbles, around which pass the straps connecting the cranks with the pedals. The caster wheel is provided with a transverse arm, which is connected with two guiding levers placed on opposite sides of the main frame.

The operator, sitting in the front seat, takes one of the guiding levers in each hand, and presses first one pedal and then the other in alternation with the feet.

The movement is easy, and the sport is healthful and enjoyable.

RUGGLES' VELOCIPEDE.

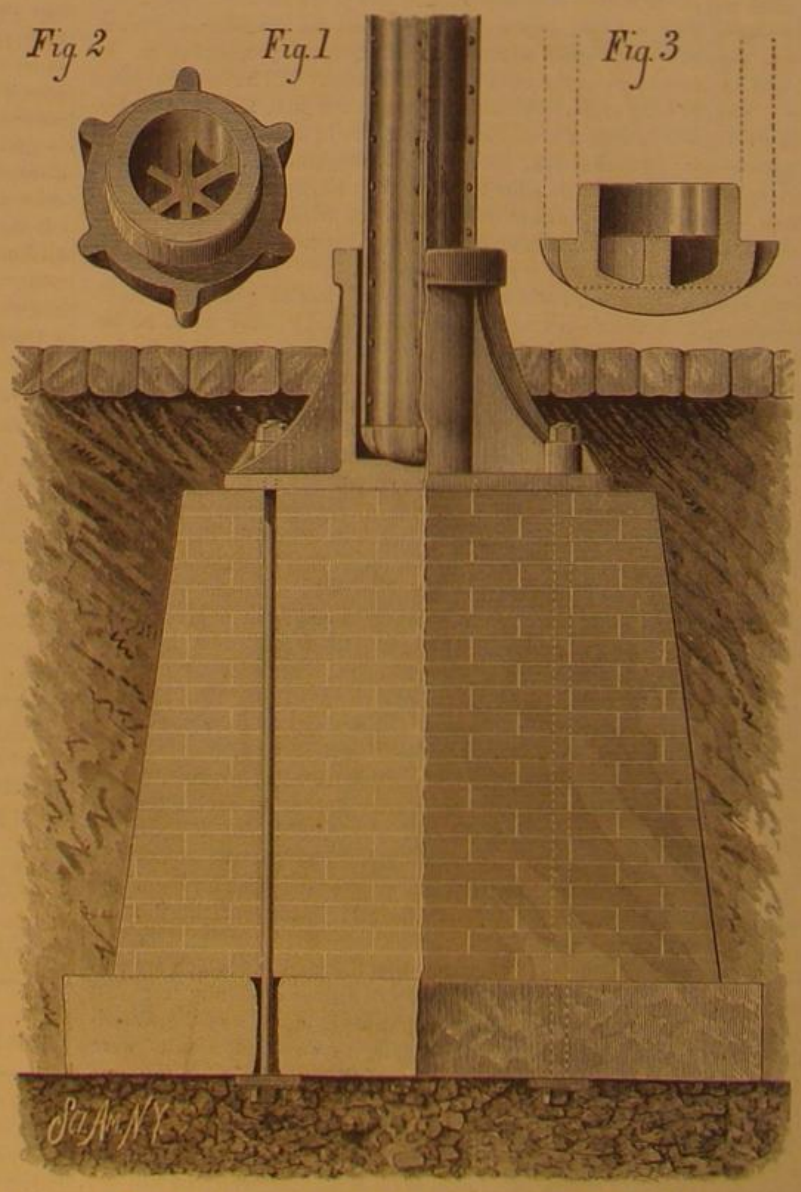
The Induction Coil.

Reviewing the new edition of "Noad's Text Book," the *Journal of the Telegraph* says: "The invention of the induction coil is credited to MM. Masson and Breguet, in 1842." As a matter of fact, the first induction coils were made by Professor C. G. Page, then of Salem, Mass., in 1837-8, consisting of a long secondary wound over a short primary coil, having a bundle of iron wires for its core, and provided with an automatic circuit breaker. They were capable of giving sparks in free air, as well as shocks and other indications of high potential. The fact that descriptions of this apparatus were published in the scientific journals of the day leaves no adequate excuse for the persistent omission of many European authors to give the credit of this apparatus to the American inventor to whom it rightfully belongs.

NEW FOUNDATION PLATE FOR ELEVATED RAILWAYS.

In a recent article on the progress of the elevated railway we gave an illustration of the foundation plates used in connection with the latticed columns on a portion of the structure. We give herewith an engraving of the combined bed plate and spherical bearing used on that part of the railway built by Clarke, Reeves & Co., of Phœnixville, Pa. It will be seen by reference to the engraving that the socket which receives the lower end of the iron column is concaved at the bottom to receive a convex bearing piece upon which the column rests. Fig. 1 in the engraving shows the iron socket plate—partly in section—in its position on the brick foundation. Fig. 2 is a detail perspective view of the bearing piece, and Fig. 3 is a vertical section of the bearing piece. The object in using a foundation plate of this kind is to secure a full bearing of the column on the bed plate under all circumstances. Without this device the column would, in many cases, rest upon one of its edges only. This may occur when the foundation plates are not exactly level, or when they are inaccurately placed and the column has to be tipped a little in one direction or the other to bring it into the required position at the top. The spherical socket and bearing piece admit of moving the column one way or the other without affecting its bearing in the base plate.

Messrs. Clarke, Reeves & Co. inform us that they have used this device in the construction of more than 120,000,000 lb. of elevated railway for New York city.



ELEVATED RAILWAY FOUNDATION PLATE.

The Best Goods Always Pay the Best.

The truth of this statement is simply verified by the experience of every observing merchant. It is not the poor and trashy stuff, put up in a cheap and nasty style, even with a very wide margin of profit, that pays the best. There may be done in some of these catch-penny goods for a short time a money-making business. That we do not deny. We have seen it in novelty articles of various descriptions. We have seen it in largely adulterated coffees and spices in honey and sirups; in candies, and canned goods. But the end has come, over and over again, to all these meretricious methods of money making on merchandise. Sometimes the inevitable is averted for a long time by factitious plans of selling by prizes of clocks and spoons, by rapidly changing from one brand to another, by constantly shifting the field of operations, and by a hundred and one ways that will not stand the test of legitimate business methods. Call to mind the goods in the market, however, that have become established and staple, and in every case they will be found to be the products of manufacturers who have made it a cardinal principle in their business to make only the best goods, and while the margin of profits is necessarily small, the stability of the market and the permanency of the demand enable their proprietors to rely upon them for an income as regular and steady as if they were government bonds.—*New York Grocer.*

MISCELLANEOUS INVENTIONS.

An improvement in grain meters has been patented by Mr. Joseph Nurnberger, of St. Albans, West Va. It consists of a double-ended vessel pivoted to the scale beam under the grain spout, a pawl and ratchet connected with the scale beam, a register, and a stop device for holding the vessel, whereby, when the quantity to be weighed and registered each time is admitted to the vessel, it turns the beam, releases the vessel, which reverses by its own gravity, empties the grain, and turns the empty compartment up under the spout, and at the same time the pawl moves the index on the register.

An improvement in folding mirrors has been patented by Mr. Nicholas F. McEvoy (Catherine McEvoy, administratrix), of Millbury, Mass. Two or more mirrors are mounted upon a standard and adapted to be placed in different positions or at different angles to each other.

An improved adjustable pillow-sham holder has been patented by Mary E. Smith and George B. Fay, of Brooklyn, N. Y. It consists of a tube provided with slots and spiral spring, and made adjustable as to length so that it may fit any bed. It is attached to the head board, and is designed to hold the pillow shams in the proper position.

Mr. Jacob Weart, of Jersey City, N. J., has patented an air forcing and carbureting apparatus for illuminating railway cars. A carbureter is placed on the car and suitably connected with the burners. A blower is connected with the carbureter, and a steam pipe leads from the boiler and connects with a coil located on the car, beneath or contiguous to a coil of the air pipe.

Mr. Isaac D. Fegely, of Shamrock (Long Swamp P. O.), Pa., has patented an improved hand pump of cheap and simple construction that, it is said, can easily raise water from a depth of one hundred feet or more.

Mr. Henry F. R. F. Somerset, of Badminton, county of Gloucester, England, has patented an improvement in loops for connecting stirrup straps to the saddles, the object being to provide for automatic disconnection of the strap in case of accident. The invention consists in a stirrup loop formed with two sides hinged or pivoted, and retained in position by spring pressure under ordinary circumstances, the hinged sides being held in such manner that the parts are released and the loop thrown open by the draught caused by the rider being thrown.

Mr. J. Theodor Schultz, of Uhlenhorst, near Hamburg, Germany, has patented an improved machine for cleaning and polishing boots and shoes. It is so constructed as to do its work rapidly and well, and it is simple in construction and convenient.

An improved mining-drill has been patented by Mr. Fred. B. Parrish, of Wilkesbarre, Penn. The invention consists in combining, with a drill-shaft arm having slotted recessed jaws, and a crank-screw on the auger, a pivoted nut having pins on opposite sides and made solid.

Messrs. Richard Hudson, of Chorlton cum Hardy, Henry Grimshaw, of Manchester, and Christopher Cronshaw (executor of John Briggs, deceased), of Bolton, County of Lancaster, England, have patented an improvement in ornamenting or transferring patterns to fabrics, printing the patterns with any bituminous substance or varnish of any color on the pattern paper, and transferring them to the fabric by the application of heat.

Mr. Mott G. Gillette, of New York city, has patented an improved tap valve for barrels which will effectually close up the tap hole and prevent the entrance of air, but at the same time does not interfere with the insertion of the faucet. It consists of an annular collar placed around the tap hole on the inside, which forms a seat for a flap valve (opening inwardly) hinged thereto and governed by a spring.

An improvement in ornamental hat bands has been patented by Marcus Goldberg, of New York city. The invention consists in a hat band formed of two or more spiral springs, placed one upon the other, and held in place by metal clasps, and also in the combination, with the springs and clasps, of tapes or cords, so that the band can be placed upon different sized hats, but cannot be expanded so much as to injure the elasticity of the springs.

An improvement in combined fire alarm and fire extinguisher, invented by Mr. John W. Smith, of Brooklyn (E. D.), N. Y., is designed to furnish an improved device, to be connected with a system of water pipes in a building. It is so constructed that should a fire occur the fire itself will open a vent for the water where the fire is, and in no other place, and at the same time will sound an alarm.

Mr. Harrison T. Rook, of Hot Springs, Ark., has invented an improved car coupling having a drawhead composed of two parts, forming what may be called a pair of jaws, of which the one is movable and the other fixed. The movable jaw is pivoted on a pin in the fixed jaw, so that when the connecting pin, which has a conical head on each end, is thrust into the opening of the draw head, the movable jaw lifts to receive the connecting pin.

A NEW SWEEPER.

The annexed engraving represents an improved sweeper recently patented by Mr. R. G. Pittman, of Rocky Mount, N. C. It is designed for sweeping streets, lawns, walks, floors, or carpets, and is provided with an adjustable brush which may be used until it is worn out; its driving gear, which is large and efficient, is placed entirely outside of the sweeper case.

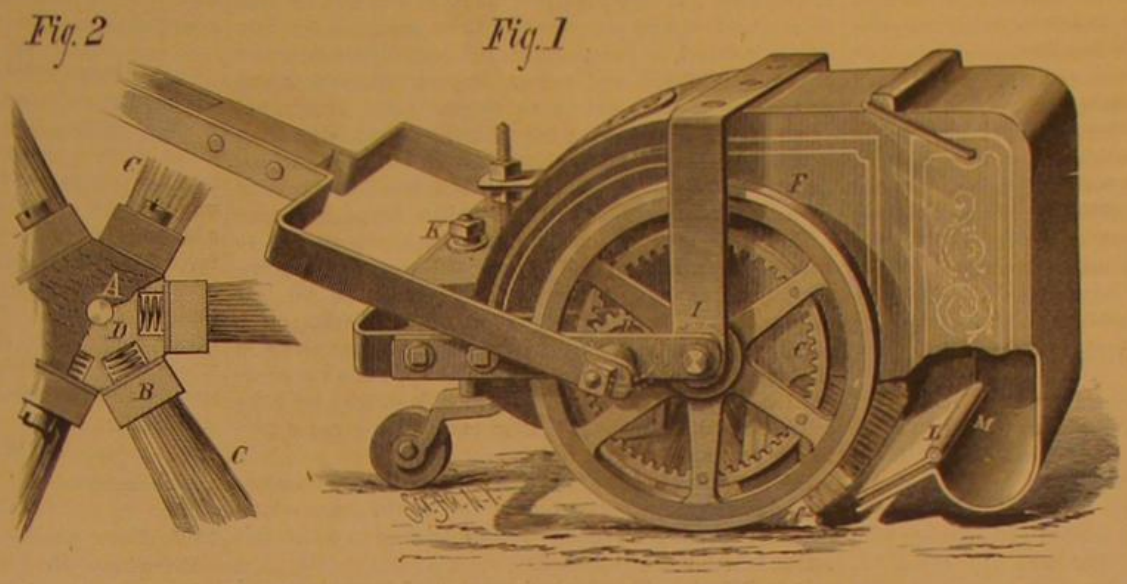
Fig. 1 is a perspective view of the sweeper, with parts broken away to show internal parts, and Fig. 2 is a detail view of the brush.

The drum, A, is provided with sockets containing spiral springs attached to the bars, B, which carry the brushes, C. The springs are retained under compression by screws at the ends of the bars, B. As the brushes wear, the screws are retracted, allowing the springs to expand and carry the brushes outward.

The brush is supported by the axle, D, upon the ends of which there are wheels, F, provided with rubber tire. These wheels revolve loosely on the axle, and one of them has attached to its inner side an internal gear wheel, G, that gears into a wheel, H, which revolves on a stud projecting from the sweeper frame, and meshes into a pinion, I, on the end of the drum, A.

The rear portion of the sweeper frame is supported by a caster wheel, and the front carries a dust receptacle, M, which is suspended from the front of the brush cover, and may be readily removed when filled. The dust receptacle is provided with a hinged apron, L, that nearly touches the floor, and guides the dust into the receptacle as it is thrown up by the brush.

Among the several good features possessed by this sweeper, perhaps the most noteworthy are the adjustable brush, the large driving wheels, and the removable dust pan.



PITTMAN'S SWEEPER.

Bamboos as Food.

The young shoots of the bamboo, according to *Les Mondes*, form in Japan one of the principal aliments of all classes of people during the spring and a portion of the summer. Those gathered on poor soil are hard and but little esteemed; but those, on the contrary, which grow in rich soil and under careful culture, are large, quite tender, and even suit the palates of a large number of Europeans. Their quality naturally lessens where they grow on mountains; and yet they are edible even at altitudes where the plant does not succeed so well as it does in Provence. For this reason, the journal above mentioned thinks there is reason to hope that this valuable article of food will be introduced and successfully cultivated in the south of France. To form a forest of edible bamboos, the country people in the vicinity of Kioto begin by breaking up the soil to a depth of about three feet, and then plant therein two-year old bamboos of a species called "Moso." The latter are then cut back to a height of about nine feet, and the plantations are afterward kept carefully free from weeds for two or three years. No crop is gathered till after the fifth year, and then only sparingly, since the forest does not attain its full growth till ten years after planting. At the latter period the annual crop is said to amount to 22,000 pounds of young shoots per hectare (2½ acres). The importance of this product leads the peasantry (who undertake the culture near large cities) to devote very good lands to it, and to manure them thoroughly in order to obtain early crops. Every year a new shoot appears on each spreading root, and the old plants, which no longer yield scions, are cut down. If care be taken not to exhaust it, a forest will renew itself indefinitely. The culture of the plant requires the use of much compost, and the plantations are also watered every year in the months of February and September with liquid manure. It is due to constant care and trouble of this kind that tender and delicate products are obtained. The stems that are allowed to grow attain considerable dimensions, often reaching a height of 24 feet, and a circumference of 35 inches at their swollen base.

Changes in Epicurean Tastes.

It is curious, says an English journal, to observe the change of taste that epicures have experienced with regard to different birds. Even to-day the tastes of two neighboring people—the English and the French—are much more unlike in this respect than one would imagine. In England, for example, the goose is held in almost as much esteem as the turkey, while across the channel the former is sold at scarcely half the price of the latter, and is regarded as nothing better than a vulgar dish. But if we compare our present habits with those of seventeen or eighteen centuries ago, the contrast will be much more remarkable still.

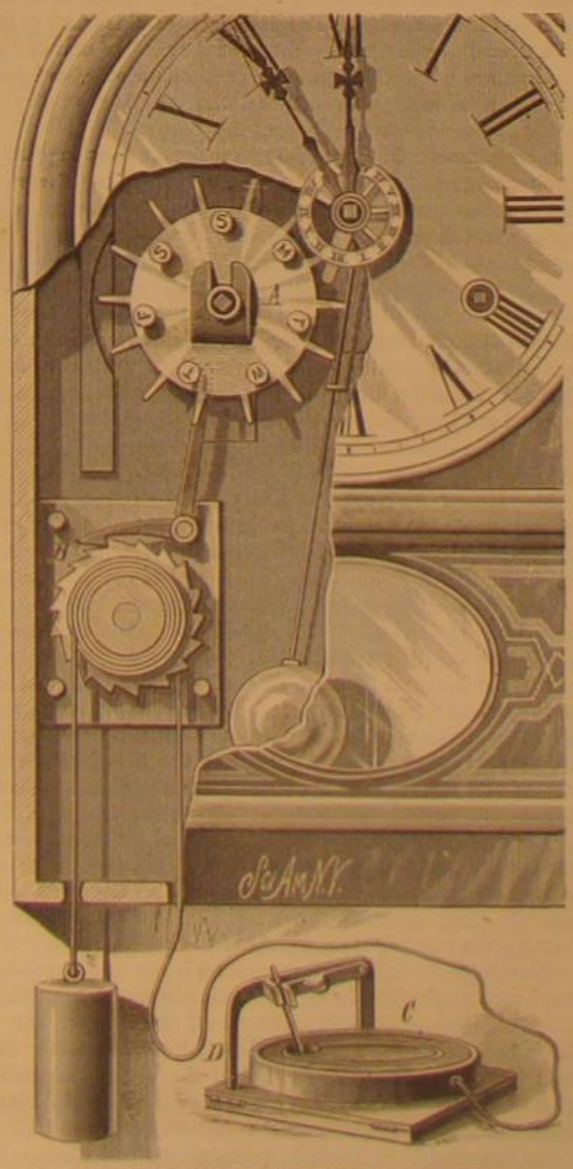
To-day we never see a poulterer's shop adorned with rows of peacocks, and should one of these beautiful birds appear upon the table at some grand public or private dinner, none of the guests would go into ecstasies over the dish, as if its delicacy was a fact universally known. But at Rome, no banquet was complete without the presence of the peacock. Among the other large birds, the cranes, the swans, and even the ostrich, were held in high esteem. Geese were also highly prized, and they were eaten not with a sauce, but stuffed with small green apples. The duck and teal were served with the juice of the orange and not that of the lemon, and they were preferred to the heathcock and woodcock. As for larks and thrushes, they were usually eaten at the end of the meal, with the idea, true or false, that it would prove a sovereign remedy against affections of the bowels. But the bird most in esteem among all the subjects of the Cæsars was the common thrush. These birds were raised and fattened in large establishments near Rome, and brought very high prices. The artificial rearing of these birds, which are excellent for the table, would prove an easy matter.

Hog Cholera.

Dr. D. N. Kinsman, Professor of the Practice of Medicine in the Columbus Medical College, has been making an elaborate study of this disease, by which, he states, $20,000,000 are lost annually in the United States. He concludes that the affection is a specific, contagious disease, peculiar to the species, and always accompanied with extensive peritonitis. It is not, as has been claimed, any form of anthrax or typhoid fever.—*Medical and Surgical Reporter.*

NEW AUTOMATIC FIRE LIGHTER.

A novel device for lighting fires automatically at any prescribed time has recently been patented by Mr. E. H. Dorscher, of Homestead, Iowa. It is intended for the use of housekeepers, country school teachers, manufacturers, and others who require a fire at a stated time. When this device is used personal presence is not required; all that is necessary is to prepare the kindlings and fuel beforehand and set the apparatus. By reference to the engraving it will be seen that the mechanism is controlled by a clock, upon the hour hand arbor of which there is an adjustable disk similar to that of an alarm clock, which carries an arm capable of engaging pins projecting from the periphery of the wheel, A. This wheel carries seven pins corresponding with the seven days of the week, and arranged so that they may disengage a pawl from the ratchet wheel, B, at any prescribed time in the day. The ratchet, B, is upon the shaft of a small windlass that is propelled by a weight when the pawl releases the ratchet wheel. This windlass winds a cord that may be extended in any direction to the stove or furnace where there is a lighter, C, consisting of a horizontal wheel, around the periphery of which is wound the cord from the windlass, and upon the upper surface of which there is a coating of sand or sandpaper. The wheel is protected by an iron cover, which also supports a clamp, D, for holding one or more matches, so that they press lightly upon the sanded surface. A piece of paper or other combustible material extends from the match to the kindlings in the fireplace. The operation of this apparatus is obvious. At the prescribed time the pawl is released, the weight drops, the sanded wheel revolves, and the fire is lighted. If it is desired to skip a day or so, the pins in the wheel, A, which represent the days to be skipped, are removed.



DORSCHER'S FIRE LIGHTING APPARATUS.

Sanitary Conventions in Michigan.

At a recent meeting of the Michigan Board of Health arrangements were made for the holding of two sanitary conventions in that State the coming winter. The first is set down for the second week in January, and will be held at Detroit; the second, at Grand Rapids, will be held in February. The subjects for discussion at Detroit will be: Abattoirs for cities; school hygiene; ventilation of living and sleeping rooms; cooking schools; plumbing for dwellings; prevention and limitation of contagious diseases; inspection of food; water supply for the family. At Grand Rapids the subjects will be: Public interest in and importance of general sanitation; school architecture in respect to its hygienic aspects and importance; sewerage, its importance, its benefits, and its dangers; sanitation of the sick room; infection, the every-day dangers of it and how to prevent it.

Accompanying these conventions will be a free exhibition of sanitary appliances, which manufacturers are invited to send. Articles of exhibit will be received by the secretary of the convention, at Detroit, by Dr. C. H. Leonard, 50 Lafayette avenue, from December 15, 1879, to January 6, 1880. The time for entering articles at Grand Rapids has not yet been determined. The judges will be invited to examine the articles exhibited, and certificates of merit will be awarded.

Harrington's Muffling Contrivance.

In our recent notice of inventions connected with elevated railways, on exhibition at the Mechanics' Institute Fair, that of Mr. John R. Harrington, of Brooklyn, was unintentionally omitted. Mr. Harrington's invention consists in a fibrous packing interposed between the base of a rail and the ties, also between the tops of the flange of the rail, and secured by caps of wood to protect the packing from the weather and against fire. Mr. Harrington also muffles the floors and sides of cars with the same material. The inventor informs us that the method is about to be put to practical test on a considerable length of elevated road.

In the course of experiments with Bower's process for coating iron with magnetic oxide by a current of hot air, it was found, Mr. G. R. Tweedie says, that the action was due to the combination of atmospheric oxygen with the carbon of the iron to form carbonic anhydride, which was then reduced by the iron according to the well known equation $4CO_2 + Fe_3 = Fe_3O_4 + 4CO$. Hence this process was found to be unsuitable for coating wrought iron or steel. The mode of procedure now adopted is to heat the articles to be coated in a current of impure carbonic anhydride, obtained by the combustion of small coal. By this means a coating of magnetic oxide is obtained slightly contaminated with red oxide, the conversion of which into magnetic oxide is then effected by adjusting the air supply of the furnace, so as to substitute a current of carbonic oxide for the carbonic anhydride, $3Fe_2O_3 + CO = 2Fe_3O_4 + CO_2$. The coating thus produced is very hard, homogeneous, and withstands ordinary oxidizing influences.

AMERICAN INDUSTRIES.—No. 24.

SOAP MANUFACTURE.

Soap is by no means a modern invention; it is so old that no one can tell when or where it originated. Specimens of it were found in the ruins of Pompeii, together with the apparatus for its manufacture. It is not our purpose to give a detailed history of this industry nor to describe generally the processes by which the great variety of soaps now found in the market are made, but to give the reader an idea of the apparatus and processes employed in the largest soap manufactory in this country, if not in the world.

Crossing the North River on one of the ferries one cannot fail to notice in the lower portion of New York city a building much higher and wider than any of the others, upon which is displayed in huge letters the name of B. T. Babbitt. The stranger might be at a loss to know whether the great manufacturer had chosen this as a conspicuous place to post his advertisement after the modern fashion, or whether it really designates the spot from which emanate the products so familiarly known all over the world; but the latter is correct. B. T. Babbitt's soap works occupy an area equal to twenty-three city lots, 25x100 feet each. This immense surface is covered with substantial brick buildings, ranging from three stories to five and eight stories in height. The aggregate floor space devoted to manufacturing is 300,000 square feet. These buildings are located on Washington and West streets; the numbers on Washington street comprising Nos. 64 to 84 inclusive, and on West street Nos. 41 to 51 inclusive.

The business offices of the concern occupy a large floor, and in connection with the establishment there is a large restaurant, where employes of the works can procure meals at reduced prices and without loss of time.

The power used in these works is furnished by twenty-five engines placed wherever power is needed, and supplied with steam from four boilers of Mr. Babbitt's own invention, ranging from 500 horse power to 60 horse power. By this arrangement long lines of shafting are avoided and the power is applied directly.

For carrying out his plans for the construction of boilers and machinery, Mr. Babbitt has extensive machine shops at Whitesboro, N. Y. Everything connected with the establishment is upon such a grand scale that it is impossible to realize the extent of the works without personal inspection.

The amount of raw material consumed in these works is astonishing. The annual consumption of some of the leading materials includes upward of 70,000 barrels of the purest white tallow, received principally from Texas; 40,000 barrels of resin from the Carolinas; immense quantities of potash are imported from England, and vegetable oils and other ingredients are consumed in proportion. All of the materials are selected with the greatest of care, and nothing but the first quality is ever bought. Notwithstanding the immense quantity of materials used in this establishment, one cannot discover the slightest disagreeable odor in making a tour of the entire works, and the most scrupulous cleanliness is everywhere observable.

In the manufacture of soap Mr. Babbitt employs six enormous caldrons made of boiler iron; the largest, which is shown in one of the views on our first page, is 25 feet in diameter and 57 feet in depth, holding 1,800,000 pounds at a single boiling. The aggregate capacity of these huge receptacles exceeds 3,500,000 pounds. The average cost of the raw materials for filling each kettle for a single boiling is $36,000, while the value of the contents of the largest caldron reaches the enormous sum of $125,000. Everything here is subject to regular system. Nothing is wasted, nothing neglected. The gigantic operations proceed with perfect regularity. Wherever possible machinery has been introduced to save labor.

The foundation of nearly all varieties of soap is pure white tallow, which is received in barrels or casks. It is transferred to the soap kettles by placing a large number of the barrels in line upon a platform with the bung downward, and introducing steam pipes, the steam from which quickly melts the tallow, when it flows into large reservoirs, and thence to the kettles. The lye, composed of potash and lime, is prepared in large iron tanks, and conducted through pipes to the kettles. After the tallow and lye are thoroughly mingled, steam is admitted to the kettles, and the boiling begins. At a certain stage in the process common salt is added, which, dissolving in the lye, increases its density, and permits the soap to float on the surface of the liquid. It requires several days to complete this process. When it is finished, the liquid soap is drawn off, and forced by means of powerful-steam pumps into large iron reservoirs, from which it is drawn through pipes into the soap frames to cool and harden. The kettles are filled in regular rotation, so that while one is boiling, the process has nearly approached completion in another, while a third is being emptied.

The average daily production of the works is about 1,500 boxes of soap, each containing 75 pounds.

The soap frames above alluded to are shallow iron boxes, made separable to facilitate the removal of the soap. Each frame holds about 1,500 pounds. After the soap has hardened sufficiently it is cut into bars by means of wires, and is afterward pressed into oblong cakes, with rounded corners, without loss of weight, and at the same time receives its imprint of "Babbitt's Best Soap," a brand which is universally recognized as a guarantee of excellence.

The description given above is applicable to the manufacture of nearly all varieties of hard soap, except the choicest kinds of toilet soap, in which pure vegetable oils take the place of tallow, or are used in combination with it. Olive, palm, and cocoanut oil are the most generally used for fine soaps. A considerable portion of Mr. Babbitt's establishment is devoted to the manufacture of toilet soaps, and in this, as in the manufacture of ordinary bar soaps, nothing but the best materials are used.

The frauds which have been perpetrated under the cover of perfumes by unprincipled manufacturers have created a distrust of the highly scented soaps, and made a demand for a wholesome soap free from such objections. Mr Babbitt, with his characteristic enterprise, met this increasing popular demand, by introducing an elegant article of toilet soap which is entirely free from artificial odor of any kind. It is made from the finest of vegetable oils, by new and original processes. "Baby Soap," as this new article is called, is peculiarly suited to the delicate skins of infants, children, and ladies. It preserves, softens, and smoothens the skin, and is an elegant toilet luxury, not only well adapted to the use of ladies and children, but equally well adapted to gentlemen's toilet. Although it has but recently been put upon the market, it bids fair to become one of the most popular of Mr. Babbitt's manufactures.

The other articles made in this establishment are so widely known and so well appreciated that it is unnecessary to add anything to the universal verdict as to their merits. Potash balls, so well known in the market, originated in this establishment. One of the upper views in the engraving shows the workmen in the operation of pouring the fused potash into the iron moulds which give it its spherical form. Each ball, after casting, is given a protective coating of melted resin.

Saleratus, an important article of trade and commerce, is made in large quantities here. One of the lower views in the engraving represents the department in which this article is weighed and packed.

It is difficult, with a limited number of engravings, and brief article, to convey a just idea of the magnitude of Mr. Babbitt's establishment. The great success of this concern is due so the fact that Mr. Babbitt combines inventive and mechanical skill with business talent of the highest order. He has been enabled to originate new and valuable processes, and to devise labor-saving machinery, by means of which he has secured great advantages over his competitors.

Vehicles of Intelligence.

Newspapers, like nations, have a historical existence. They "go to and fro" in the world and exert a powerful influence. Tribes and individuals far removed from hearing what is transpiring among men are always ignorant and degraded. That person who uses means to obtain a record of passing events always improves and advances in knowledge; the man who is dead to such influences is dead to his own best interests. Well did the old Greeks know the value of obtaining new information. When voyagers and travelers came to their ports and cities they were taken to their public marts and requested to recite an account of what they had seen and heard abroad. The influence of this custom, before the art of printing was discovered, was like that of our modern newspaper; it tended to excite the people, and lead them to achieve reputation in all that was held worthy of being distinguished.

As attainments in the useful arts make men distinguished and nations great, we take occasion to solicit the favor of our constant readers in extending the circulation of a paper devoted to disseminating such information among the people as is useful and elevating. We urge our friends to give us their assistance in presenting the claims of the SCIENTIFIC AMERICAN to their acquaintances. We have no doubt but there are a great many mechanics, manufacturers, and others who would become subscribers were our paper brought to their notice, and its character and advantages pointed out by those who know it well.

SOME RECENT INVENTIONS.

Mr. Ernest W. Noyes, of Bay City, Mich., has patented an adjustable toe weight for horseshoes, which consists of a weight with a longitudinal dovetailed groove, which engages an inclined bar rising from the edge of the shoe. In the groove is a spring pawl adapted to engage holes in the bar, whereby it can be fixed at different points to adapt it to the throw of the animal's feet.

Upon elevated and other steam railways the platforms are usually fitted with gates, which are opened to permit passengers to pass out and closed when the train is in motion, and the signal to the engineer for starting the train is given by means of a bell rope when all the gates are closed. There is always a liability of the signal being given before all the passengers are off, and of the occurrence of serious accidents by starting the train too soon. Mr. J. Charles E. Ohlenschläger, of New York city, has patented an improved electric signaling apparatus, which prevents the signal from being given until all the gates are closed.

An improvement in button holes for boots and shoes has been patented by Mr. Benjamin L. Newhall, of Lynn, Mass. The invention consists in a process of re-enforcing button holes by inserting a blank coated with "compo" in the flap and setting it thereto by pressure, in the peculiar construction of the blank, and in the mode of combining the blank with the flap.

An improved oil cabinet, patented by Mr. James M. Thayer, of Randolph, Mass., is designed for the use of retail dealers in oils and other liquids, corporations, factories, etc., which allows the oil or other liquid to be drawn in any desired quantity and without drip or waste, and prevents any escape of odors into the room.

An improvement in loom shuttles has been patented by Messrs. Adna B. Roberts and Le Roy Lyons, of Manchester, N. H. The object of this invention is to furnish shuttle spindles so constructed as to hold the bobbin upon them when lowered into the shuttle, and allow the bobbin to be readily put on and taken off when raised out of the shuttle.

Messrs. Gideon B. Massey and Edward E. Spencer, of New York city, have patented an improved revolving shoe heel, which is so constructed that they will allow the curve of a French heel to be continued across the edge of the revolving part, and that will give no indication to a casual observer that there is a revolving part.

Minneapolis (Minn.) as a Milling Center.

The substitution of "St. Paul" for "this city," in a statement of milling operations at the Falls of St. Anthony, given on the authority of the *Pioneer Press*, of St. Paul (SCIENTIFIC AMERICAN, October 25), was the means of doing unintentional injustice to the rival city of Minneapolis. As a business center the latter has outstripped her older but less favorably situated sister; and now the mills of Minneapolis have, it is claimed, something like five times the capacity of those of St. Paul. When mills now building are finished her capacity will reach 15,000 barrels of flour a day. Another of her great industries is the manufacture of lumber, amounting to 200,000,000 feet a year.

Correspondence.

Ice Boat Propulsion.

To the Editor of the Scientific American:

Referring to the subject of the propulsion of ice boats by sails, recently revived, it seems to be accepted as a fact that such boats may travel faster than the wind, without any serious effort being made to solve the problem. It ought not to be mysterious to scientific men, and is only so because sufficient thought is not given to the matter.

The error in this question consists in considering the velocity of the wind at all, except as the means for producing the pressure by which the boat is propelled. Given the weight to be moved, power required to overcome inertia and friction, and speed desired, the extent of sail, surface, and the wind pressure required to propel the boat may be very nearly calculated. The principle is the same with all boats using sails, whether in water or on ice, the difference being that the power to propel a vessel in water is great, while but little power is required with ice boats. With vessels in water the result is a great weight moved slowly, or in other words, the pressure of the air, the power converted to the motion of the vessel, is represented by a comparatively low rate of speed. If it were practicable to spread sufficient canvas, a vessel could be propelled in water faster than the wind.

With an ice boat the conditions are changed: the weight is small compared to spread of canvas, and the friction slight, so that the power obtained, transformed to speed, gives a resultant velocity in some cases greater than the wind.

The wind pressure on a plane surface exposed to its direct action is much greater than usually supposed. From tables we find the pressure on such surface to be 2 lb. for each square foot, with wind moving 20 miles an hour, and with the velocity increased to 60 miles an hour the pressure increases to 18 lb., so that with an exposed surface of 1,000 square feet there will be a constant pressure of 18,000 pounds. This applied to force an ice boat forward must give great speed, and the boat rushes forward until the equivalent of the power is obtained in speed. The pressure due to the wind velocity being obtained, that velocity may be eliminated from the problem. As an example, suppose it requires a wind velocity of 20 miles, or a pressure of 2 lb. per foot, to propel the boat at the rate of 20 miles an hour. Now, suppose the wind velocity be trebled, the pressure then runs up to 18 lb., nine times that required before; we then have an actual force which must be expended to increase the speed of the boat until an equilibrum is established. The query that naturally arises here, is this: Will not the pressure cease the moment the boat exceeds the wind in speed? If air was a non-elastic fluid, that would be the result; but air is elastic; its pressure on the sails is due not only to its momentum but to its elasticity by compression against the exposed surface, and this elasticity is a constant acting force, which, exerted under the favorable conditions provided by an ice boat, gives the result of a great speed. Were this not so, there would be a limit to the size of vessels which could be propelled in water by wind pressure, and a large spread of canvas would have but slight advantage over a smaller exposure. This can be illustrated by a boat floating with the current of a stream: its speed could not be increased by wings projecting at each side; it would move forward with greater force, but at the same speed.

The same principle is seen in a turbine water wheel, the weight in that case taking the place of the elasticity of the air as a constant force. There is the same difference in character of operation between a current water wheel and a turbine as there is between an ice boat moving with a gentle breeze and one sailing under pressure of a high wind.

W.

The Experience of an Early Inventor.

In a recent communication referring to our lately published article on conspiracies to nullify the patent laws, Mr. Thomas Shaw, of Philadelphia, gives the following particulars relative to the experience of one of America's earliest inventors. He says:

From the place where I am now sitting I can throw a stone into the small triangular lot once occupied by the little shop of Olivar Evans. I frequently see his grandson, who has in his possession the diary and the few other papers left by that celebrated inventor, who designed the greatest improvements in milling machinery known to-day. To him millers are indebted for the first great improvements that helped make the working of grist mills automatic. The *American Miller* says of him: "He was not only the pioneer inventor in American milling, but the pioneer millwright as well. Before his time there were no American names that could be classed as mill engineers. He stood alone, and for decade after decade his work on milling was the text book of millers and millwrights alike. Still but few are acquainted with the life of this great man."

In another place the same paper says: "Olivar Evans was born in Newport, Delaware, some time in the year 1755 or 1756. Little is preserved of his early history. His parents were agriculturists of respectable standing, who gave their son the advantages common to people in their station. At the age of fourteen Evans was apprenticed to a wheelwright. An anecdote is preserved which displays in his character even at this period the ardent desire for knowledge and that determination ever evinced not to let any obstacle interfere with the object of his pursuits. His master, an illiterate man, observing his apprentice employing his leisure evenings in study, through motives of parsimony forbade him using candles; but young Evans was not to be discouraged, for collecting at the close of each day the shavings made from his work, he would take them to a chimney corner and by their uncertain light pursue his evening studies."

The benefit of Olivar Evans' inventions in milling machinery in this country alone would reach over $100,000,000 a year in cheapening and improving flour, for he designed the elevator, the conveyor, the popperboy, the drill, and the descender; which devices are now variously applied in different mills, rendering the grinding of wheat into flour completely automatic, yielding better flour at less cost, and making 28 pounds of superfine flour more to each barrel than was made by the old method. He was the first inventor of the high pressure engine, the model of which is now in the possession of the Franklin Institute, of this city. Without this invention locomotives could not have been built. It made possible the building of railroads throughout all the world, and bestowed a benefit upon the human race so great that the entire wealth of the United States would only represent a fraction of it.

I could enumerate many other valuable inventions of this noble man, but we have at present seen enough to know his usefulness. Let us now consider how he was rewarded.

He made in his diary, May 21, 1809, the following record, which is copied verbatim:

"For 4 or 5 years past my mind has been agitated between hope and despair respecting the fate of 3 of my most valuable discoveries, one of which was for no less object than the navigation of the Mississippi against the stream. I had calculated that in some future day they would be worth millions of dollars annually to this country, yet I could see nothing but ruin to myself or any of my family who should attempt to put them in operation, and I had often thought of destroying all my papers relative to them, but hesitated.

"On the 1st of this month, May, in the Court of the U. S. for Penna. District, an opinion was delivered but not made final, which I consider as highly hostile to the rights of inventors of useful improvements and patent rights; indeed I am told that the judge had, a day or two preceding, declared a patent right to be an infringement of public right.

"Such doctrines from such authority determined me that patent rights were property too untenable to be worthy of the pursuit of any prudent man. That it was highly dangerous to leave my papers to lead any of my children or grandchildren into the same road to ruin that had subjected me to insult, abuse, and robbery all my life. I was then in my 54th year, and had in 3 years last done more to acquire permanent property by renouncing such pursuits and following regular business than in 30 years before.

"I went home, collected all my drawings, specifications, and explanations, which had cost me immense study and labor of mind, called my family together, declared that it was for their good I was going to destroy them, lest they might prove the ruin of any of them, and to enable me to pursue regular business the remainder of my life for their support. They all approved, and I laid them on the fire. Thus went the best half of my inventions."

I append the following certificate:

"A correct copy from a leaf in a diary of Olivar Evans.

[Signed] "OLIVAR EVANS WOODS.

"October 9th, 1879."

Mr. Evans was well aware of the value of his improvements, and his predictions in reference to the steam carriage were truly prophetic. In some of his writings, published in the early part of the present century, he remarks:

"The time will come when people will travel in stages moved by steam engines from one city to another almost as fast as birds fly, fifteen or twenty miles an hour; passing through the air with such velocity, changing the scene in such rapid succession, will be the most rapid, exhilarating exercise. A carriage (steam) will set out from Washington in the morning, the passengers will breakfast at Baltimore, dine at Phila., and sup in New York, the same day." How far these predictions are fulfilled we leave the reader to judge. Evans seemed to be in great need of assistance, and it is unfortunate that Pennsylvania did not make him some proper reward, in view of the great monetary advantages derived by the entire commonwealth from his inventions.

This they not only failed to do, but, on the contrary, when Evans ran his first steam wagon out upon a street (now in my view) and happening to run against an old wooden lamp-post, this same legislature was prompt to pass a vote of censure by enacting a law specially provided because of this accident, forbidding him and others from ever having any more such nonsense, as they called it. And this law stands on the statute to this day, let it be said to the disgrace of our modern legislature, many members of which have been enriched by, and all enjoying the comforts and privileges of, the great invention of this noble inventor, whose misery was augmented by his highest and best efforts, until in utter despair, after years of toil, he assembled his family, recited his burdens that had become unendurable, and then destroyed his models and papers, as recorded in his diary.

I cannot help noting here a few extracts from Olivar Evans' papers to his counsel, papers that would make some 20 columns of the SCIENTIFIC AMERICAN. In one paper he says: "I was reduced to such abject poverty that my wife sold the tow-cloth, which she had spun with her own hands for clothing for her children, to get bread with." In another paper he states: "I was left in poverty at the age of 50, with an amiable wife to support, for I had expended my last dollar in putting my Columbia steam engine into operation, and in publishing the 'Steam Engineer's Guide.'" In another paper he says: "All prudent inventors are deterred from risking the expense, encountering the difficulties, the opposition, the persecution, the derision, and the sarcasm until he does succeed; and afterward the calumny, the insult, abuse, and robbery of a wicked and unjust minority of the people, too powerful for him to withstand, and the great expense of the process of the law, amounting to complete denial of justice to all poor patentees who cannot bring a cause to trial, for if cast, the cost and expenses would ruin them. Of upward of eighty of my discoveries which might prove very useful, not more than six are in operation."

A poor inventor (and they are generally poor) may be likened unto a man in possession of ordnance without ammunition, and it does seem to be the height of folly and wicked beyond measure for railroad companies and other large corporate bodies, whose entire business depends upon mechanical invention, to combine together against inventors; since without invention there would be no railroads, the railroads should not unmake the inventor.

No amount of patent law can avail the inventor so long as it can be surrounded with a wall of provisions that takes years to penetrate, and only with golden ammunition.

The papers of Olivar Evans referred to contain much valuable information, and I hope you will conclude to publish them at some future time, and give this present matter place in your valuable paper.

The Broker's Agency.

In connection with the various questions raised concerning the agency of the broker and his responsibility, the decision rendered recently by the U. S. Circuit Court in this State, in the case of Grace *vs.* American Central Insurance Company, will be read with interest by the fraternity. It will be found in full in the October number of the *Law Journal*. The issue was a peculiar one. The insured had applied to N., an insurance broker, who in turn obtained the policy through A., another broker. Immediately following the usual cancellation clause was the provision making any other person than the insured, who might procure the insurance, the agent of the insured in any transaction relating to the insurance. Notice of cancellation was given by the company to A., and accepted. On the night following, and before the insured had learned of the cancellation, the property burned. The insured contended that the broker was not his agent to accept cancellation; that he had vested him with no authority other than to procure the policy; that A. was not his agent in any event, N. being the real party authorized to procure the insurance. He also insisted that such a construction of the clause, as would allow the broker to accept cancellation would be exceedingly unjust to the rights of policy holders, and that he was entitled to the benefit of a reasonable time, sufficient to learn the fact and cover the risk elsewhere.

Of course the main question turned on the construction which was to be given to the clause in question. Heretofore the popular interpretation of the provision, making the party procuring the agent of the insured, has been that this agency had special reference to his acts in obtaining the policy, or if anything farther were included it was of a general character relating to the whole business. But the court, in this case, accepted neither construction. On the contrary, it defined the scope of the agency by the immediate context. The stipulation was with regard to cancellation, and it was with special reference to this that the party procuring the insurance was made the agent of the insured. He was such agent for the purpose of accepting notice, and being made so by the contract, notice to him was notice to the insured, and operated from the time it was given, irrespective of any hardship which might result to the insured. It does not appear that in the opinion of the court this construction militated or was intended to militate against the agency of the party applying, in any matter of procuring the risk, but simply to confine it to such acts as would naturally belong to the relations between a company and the only party whom it knew in the transaction.

The decision, however, shows the important character of the trust which is reposed by the insured in the broker whom he employs. His responsibility is not ended, as is so commonly supposed, when the contract has been obtained and securely locked in the owner's safe. On the contrary, any subsequent matter which may arise in the case of policies framed like this one, which calls for a communication from the company, may revive that agency and make its dealings with the broker effectual. Should the latter prove careless or recreant, his employer must suffer, though doubtless not one in ten supposes he is vesting such authority in his go-between. The moral of the whole case is that parties employing brokers should see to it that they are placing their business in the hands of responsible men; not merely men who can drive the sharpest bargains and get their risks taken at the lowest rates, but who will thereafter continue to care for their interests. In thousands of contracts the position of the broker is made as truly fiduciary as that of the guardians of a savings or life insurance fund.—*Insurance Monitor.*

The Foreign Fruit Trade.

The condition of the foreign fruit trade of Philadelphia has rarely been livelier at this period than it is at the present date, says the *Confectioners' Journal*. Raisins have recently advanced 50 cents per box in consequence of recent severe weather on the coasts of Southern Europe. They now command $2.25 to $3 per box, and are coming in freely. The steamship Escurial arrived here from Malaga early last week, bringing 50,000 boxes. This is the busy season for raisins, owing to the demand for the holiday trade.

Oranges are coming in very rapidly, nearly all from Louisiana and the West Indies. A cargo of 300,000 has just arrived, consigned to the house alluded to. These came from the Bahama Islands, and hundreds of thousands are coming in every week. Oranges will continue to arrive in large quantities from Louisiana and the West Indies until December 1, when they will begin to arrive from Valencia and the Island of Sicily. Oranges from the latter places will come until next August. Oranges now sell for $18 and $20 per 1,000 wholesale.

Lemons are arriving in small quantities, and the supply is not what is desired. They are brought principally from Malaga, but after the 1st of December they will come from Sicily. About four-fifths of the lemons that come to this country are shipped from the Island of Sicily, and they will continue to arrive until next September. Lemons now sell for $5.50 per box of 350, wholesale.

The market is overstocked with domestic grapes, and California grapes are beginning to come in large quantities. Among the choice grapes are the white ones from Almeria, Spain, and they come in 50 pound kegs, and they, as well as the best California grapes, sell for $6 and $7 per package of 50 pounds. Malaga grapes come in moderate quantities, and sell for $6 and $7.50 per package of 45 pounds. It is thought the recent storms in Spain will increase the price of grapes about 40 per cent. White grapes will continue to arrive for the next three months.

Bananas are steady, and a very brisk trade is being done. An average of two steamship loads per week come to this port, and this firm imports an aggregate of 20,000 bunches per month at the present time, each bunch containing an average of 12 dozen bananas. They sell for about $2 per bunch. During last March the firm mentioned imported 50,000 bunches. The best months for importation are March, April, May, and June.

Cocoanuts are being imported in large quantities, and the confectioners in the city use up about 500,000 of them per month. One house (Croft, Wilbur & Co.) has a contract for 100,000 per month. They come from Jamaica, Cuba, and the Spanish Main, and sell from $37.50 to $50 per thousand.

Pineapples arrive in April, May, June, and July. They come from the Bahama Islands, and between 2,000,000 and 3,000,000 reach this port every year.

Railway Birds.

An engine driver on one of the Scotch lines reports that he has noticed that certain hawks of the merlin or "stone falcon" species make use of the passing of the trains for predatory purposes. They fly close behind the train, near the ground, partly hidden by the smoke, but carefully watching for the small birds which, frightened by the train as it rushes roaring past, fly up in bewildered shoals; the merlins then, while the little birds are thinking more of the train than of lurking foes, swoop on them from the ambush of the smoke, and strike them down with ease. If they miss, they return to the wake of the carriages and resume their flight and their hunt. They can, it seems, easily keep pace with an express train, and outstrip it when they please.

ALOES AS A DRESSING FOR WOUNDS.—Dr. Millet, a French army surgeon, recommends powdered aloes as a dressing for wounds, both as a means of favoring cicatrization and for closing them. It is said to relieve the severe pain of wounds almost immediately, and requires to be renewed only at long intervals.—*Boston Med. and Surg. Journ.*

NEW MUSICAL INSTRUMENT.

The novel musical instrument shown in the accompanying engraving is called the autophone, and is manufactured by the Autophone Company, of Ithaca, N. Y. It is a wonderfully simple instrument for one that accomplishes so much. It requires no special skill to operate it, and one kind of music may be played as well as another. The instrument, as will be seen by comparing it with the hand which is operating it, is quite small.

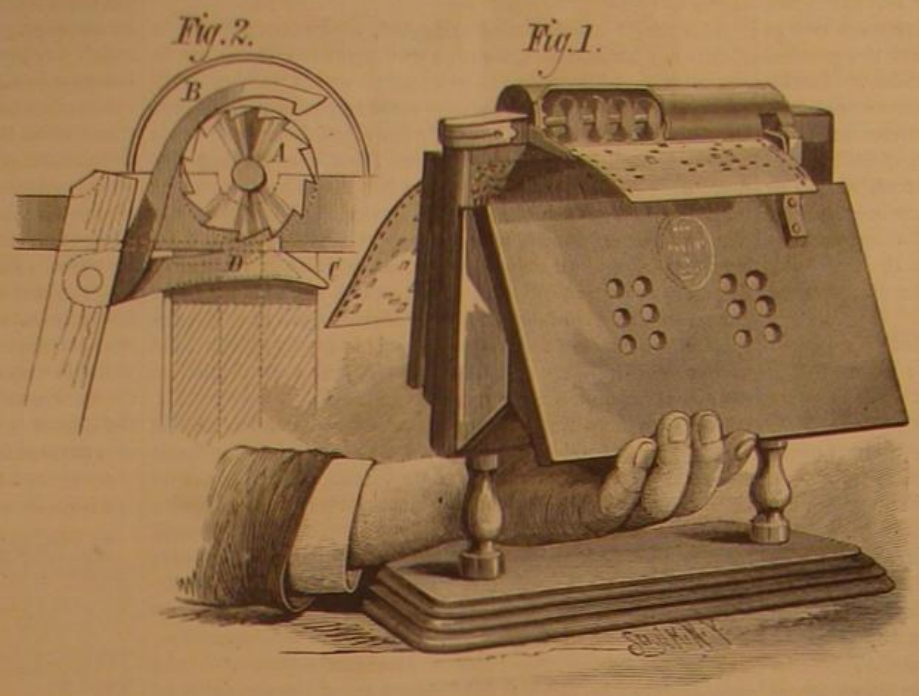
It consists of an upright rectangular board, having on one side a bellows, and upon the other a flexible air chamber, communicating with a set of reeds in the upper edge of the board. Above the reeds there is an apertured plate, and each reed has an aperture of its own. Above the plate there is a shaft carrying a series of thin disks, which serve to hold the perforated music sheet down upon the apertured plate. The shaft is pressed downward at each end by a spring, and carries at opposite ends toothed wheels which engage corresponding perforations in the music sheet.

The music sheet consists of a strip of Bristol board having perforations corresponding to the notes to be sounded. At one end of the shaft there is a ratchet wheel, A (Fig. 2), which is engaged by two pawls, B C, pivoted to an arm extending upward from the bellows. The pawl, B, always engages the ratchet wheel when the bellows is compressed, and the pawl, C, engages the ratchet wheel when the bellows expands, but it does not do so regularly, its movements being controlled by the arm, D, shown in dotted lines. This arm has a triangular projection at one end, which rubs upon the under surface of the edge of the music sheet and holds the pawl, C, out of engagement with the wheel, A, except at such places in the music sheet as are perforated to admit the end of the arm, D, when the pawl, C, will engage the wheel, A, and assist in moving it forward. This ingenious device is for the purpose of executing the quick notes, and to economize space in the music sheet.

As the music sheet is propelled by the regular working of the bellows, it acts as so many valves controlling the escape of air from the reeds and thus producing the music.

The most remarkable feature of this invention is the regularity and perfection with which the music is rendered. All of the parts are played, and the music is of no mean order. While it is a very amusing thing, it is also of very great utility, for those who are without musical talents can play as well as those cultured in the art, and many who would not feel warranted in purchasing an organ or piano can, at a very moderate outlay, provide themselves with both an instrument and a player. It must also prove of great use in schools and other places, as an accompaniment to singing.

Each instrument is provided with a number of perforated music sheets, and we understand that music adapted to the instrument can be furnished at any time.



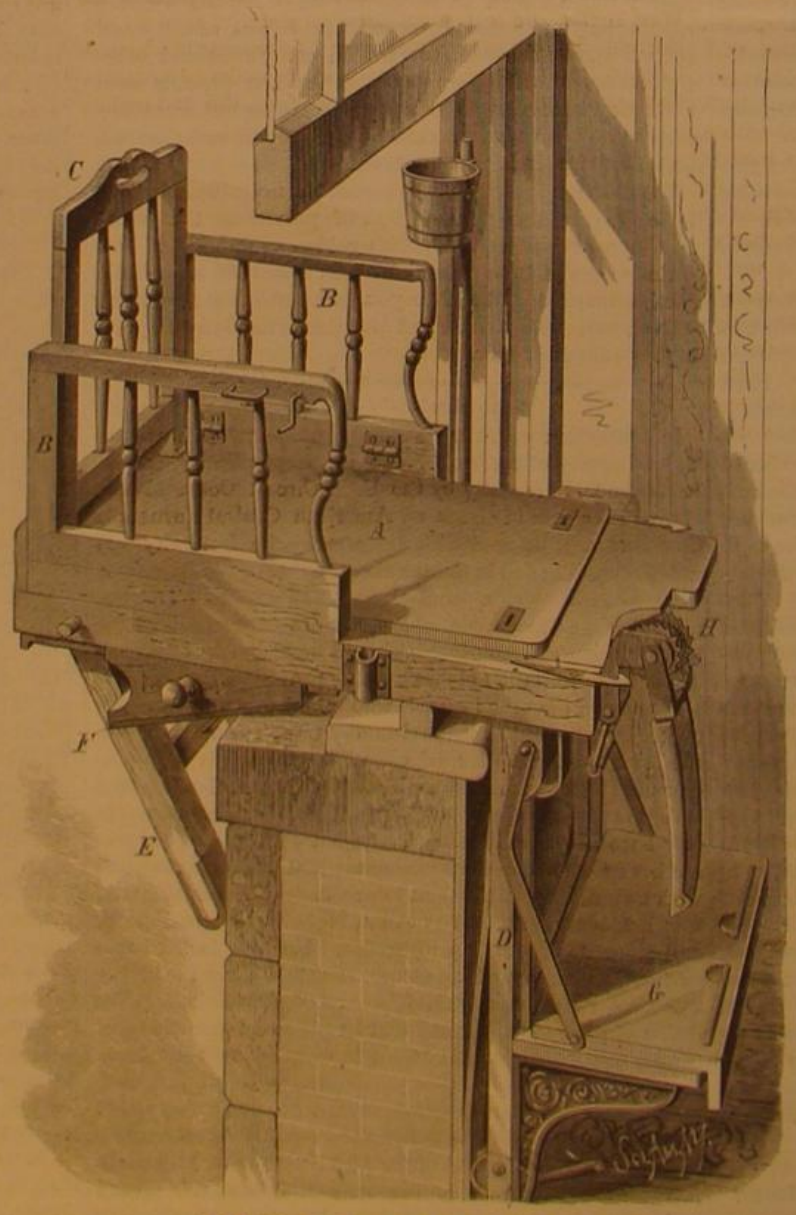
THE AUTOPHONE.

NEW WINDOW CLEANING CHAIR.

The great danger attending the cleaning of windows, especially in our high city houses, and the necessity of some means for guarding against the falling of servants while cleaning high windows, has led to the invention of the window cleaning chair shown in the annexed engraving. The inventor, Mrs. Henry Dormitzer, of 27 East 74th street, New York city, has received four United States patents on this device, and has also patented it in Canada, England, France, and Austria. The application of the chair will be readily understood by reference to the engraving. It is made adjustable, to adapt it to different kinds of windows, and when it is not in use it may be folded up compactly and laid away.

The platform, A, is of suitable size to sit or stand upon, and is provided with folding sides, B, and a folding back, C. When the sides and back are in the position shown in the engraving, they are retained in place by hooks. A frame, D, hinged to the front edge of the platform, supports the main step, and is provided with two eccentrics that are employed to press two springs against the wall to form a good bearing for the frame. The platform, A, is furnished at each side with a leveling wedge, F, which is moved out or in to adjust the bearing of the platform on the window sill. Below the platform there is a pivoted brace, E, that is drawn with more or less force against the outer surface of the wall below the window sill by a strong rawhide cord, wound around a small windlass, H, located under the front edge of the platform. This windlass is provided with an ingenious lever and pawl arrangement by which the lever, E, may be drawn against the wall with any reasonable amount of pressure. The lever, E, is adjustable and may be moved to accommodate the device to walls of different thicknesses. The inventor of this window cleaning chair has left nothing out that will increase the safety or convenience of the device. Means are provided for holding cups, pails, etc., in different positions, and an auxiliary step, which folds down upon the main step, may at any time be raised up above the platform, A, to facilitate reaching the upper portion of the window.

This device is easily and quickly applied to any window affording a safe support, and when it is not in use it is folded very compactly, so that it occupies but little room for storage.



WINDOW CLEANING CHAIR.

THE average amount of time lost to each laborer in Europe on account of sickness, according to Dr. Edward Jarvis, is from nineteen to twenty days each year. That among students is from two to five days. According to the Massachusetts Board of Health, during the year 1872, thirteen days' labor was lost by sickness for each productive person in the commonwealth.

AMONG the latest German patent applications there is one for the process of making a green color by oxidizing the sulphide of tetramethyldiamidotriphenylmethan.

Another Audiphone.

Professor J. W. Graydon, of this city, has for some time past been experimenting with a new invention called the audiphone, which is intended to supplant the old ear trumpet for use by the deaf. There has been an audiphone invented in Chicago, but Professor Graydon claims that his instrument is a great improvement upon that.

The audiphone, as constructed by Professor Graydon, consists of a small electro-microphone, to the center of the diaphragm of which is attached a cord, which may be of any length, and to the other end of which cord is attached a small piece of wood. The manner of working the instrument is very simple, and can be briefly described as follows. The deaf person takes a firm hold of the piece of wood between his upper and lower teeth, and the party desiring to converse with the deaf talks through the electro-microphone attachment at the other end of the cord, holding the cord taut. The theory advanced is that the sound is conveyed through the nerves of the teeth and the bones of the face to the auditory nerve, which, owing to some defection of the ear caused by disease, is not approachable through the usual channel, thence to the brain. The instrument will only work, however, when deafness has been caused by disease. In case of paralysis of the auditory nerve it is useless. Some very interesting tests of the audiphone were made at the deaf and dumb department attached to the Third Intermediate School recently. Among others was one, a bright looking colored girl, who was entirely deaf. The professor talked to her at a distance of twenty-five feet through the instrument, and she repeated after him everything which he said. Another was a little girl who had been deaf and dumb from birth. Using the mute alphabet she informed the teacher in charge that she could hear that one statement of the professor was made in a louder tone of voice than another, but that she could not understand what he said, never having been able to hear such sounds before. In some other cases, however, the pupils upon whom the instrument was tried said, in their mute language, that they were unable to distinguish any sound whatever. It is fair to presume that the instrument will, as have the telephone and microphone, be greatly improved, and that at no distant day it will be of great service to those afflicted by deafness.—*Cincinnati Gazette.*

How the Pennsylvania Railroad is Inspected.

The annual inspection of the Pennsylvania railroad by the executive officers of the company began October 22, the inspectors traveling in four special trains. The observation trains consist of an engine drawing a hotel and dining room car, and pushing a "gondola," that is, a low, open platform car, with seats raised in tiers, the superintendents occupying the first train, the civil engineers the second, the road supervisors the third, and the division foremen the fourth. Each gentleman is provided with a printed form, on which he marks on a scale of from 1 (very bad) to 10 (perfect) his estimate of each section of the roadbed. The verdict is reached by considering the condition of the track line, and the ballasting, ditching, draining, policing, and neatness of the work. When the trip is completed these cards are made up and an average struck for each section. The highest average indicates to which of the supervisors shall be given the first prize, usually a chronometer gold watch and chain appropriately inscribed, and to which of the division foremen the second prize shall be given. There is great competition for these prizes, and the system begun some ten years ago has been found to be of the greatest value in getting the best kind of work done on the roadbed and line of rail. Most of the superintendents on this trip have intimate practical knowledge of what constitutes a perfect road, for they have served the company of which they are now officers as roadmasters and division supervisors, winning experience and promotion in that way. Last year the inspection was extended over all the leased lines of the company, the superintendents passing over on their trip more than two thousand six hundred miles of the company's track. In doing this, however, they were not able to give the track that close scrutiny which the importance of their errand demanded.

Therefore this year the trip will be confined to the main line and its important branch, the Northern Central Railroad from Harrisburg to Washington and Sunbury. Last year the section south of Newark, a part of Superintendent McCrea's division, won all the prizes.

The Cause and Prevention of Apple Rot.

Mr. C. H. Peck, the State Botanist, in his recently issued annual report to the Regents of the University of the State of New York, says:

While on the way from Summit to Jefferson, in Schoharie County, an apple tree was observed on which much of the fruit was discolored, and appeared as if beginning to decay. Some of the passengers in the stage remarked that they "never before knew of apples rotting on the tree." Some of the fruit was procured and found to be affected by a fungus known to botanists by the name of *Sphæropsis malorum*, or "apple sphæropsis." It has been described as attacking "apples lying on the ground" in winter. Here was an instance in which the apples were attacked while yet on the tree, and that, too, as early as September. The apples attacked by the fungus are rendered worthless, and experiments recently made indicate that the disease is contagious, and may be communicated from one apple to another. For example, a perfectly sound apple was placed in a drawer with one which was affected by the fungus. In a few days the sound apple began to show signs of decay. Its whole surface had assumed a dull brown color, as if beginning to rot. Two or three days later small pale spots made their appearance, and in the center of each there was a minute rupture of the epidermis.

An examination of the substance of the apple in these pale spots revealed fungus filaments that had permeated the cells of the apple. In two or three days more numerous minute black pustules or papillæ had appeared. They were thickly scattered over nearly the whole surface of the fruit. These constitute the sphæropsis. When microscopically examined each one of these black papillæ is found to contain several oblong pale fungus spores, supported on a short stem or foot stalk, from which they soon separate. It would be well, therefore, whenever this fungus rot makes its appearance, to remove the affected apples at once from the presence of the others, whether they are on the tree or not. It is not enough to throw them on the ground by themselves, for this would not prevent the fungus from maturing and scattering its spores. They should be buried in the ground, or put in some place where it will not be possible for the fungus to perfect itself and mature its spores or seeds. In this way the multiplication of the spores and the spread of the disease may be prevented.

TADPOLES.

The chief interest of the frog lies in the curious changes which it undergoes before it attains its perfect condition. Every one is familiar with the huge masses of transparent jelly-like substance, profusely and regularly dotted with black spots, which lie in the shallows of a river or the ordinary ditches that intersect the fields. Each of these little black spots is the egg of a frog, and is surrounded with a globular gelatinous envelope about a quarter of an inch in diameter.

On comparing these huge masses with the dimensions of the parent frog, the observer is disposed to think that so bulky a substance must be the aggregated work of a host of frogs. Such, however, is not the case, although the mass of spawn is forty or fifty times larger than the creature which laid it. The process is as follows: The eggs are always laid under water, and when first deposited, are covered with a slight but firm membranous envelope, so as to take up very little space. No sooner, however, are they left to develop, than the envelope begins to absorb water with astonishing rapidity, and in a short time the eggs are inclosed in the center of their jellylike globes, and thus kept well apart from each other.

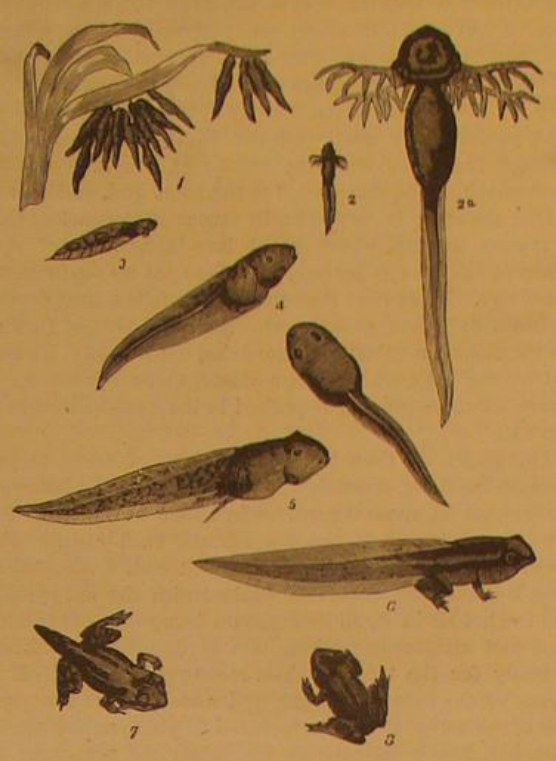
In process of time, certain various changes take place in the egg, and at the proper period the form of the young frog begins to become apparent. In this state it is a black grub-like creature, with a large head and a flattened tail (Fig. 1). By degrees it gains strength, and at last fairly breaks its way through the egg and is launched upon a world of dangers, under the various names of tadpole, pollywog, toe-biter, or horsenail (Fig. 2).

As it is intended for the present to lead an aquatic life, its breathing apparatus is formed on the same principle as the gills of a fish, but is visible externally, and when fully developed consists of a double tuft of finger-like appendages on each side of the head. The tadpole, with the fully developed branchiæ, is shown at Fig. 2 *a*, in the accompanying illustration. No sooner, however, have these organs attained their size than they begin again to diminish, the shape of the body and head being at the same time much altered. In a short time they entirely disappear, being drawn into the cavity of the chest and guarded externally by a kind of gill cover, as seen in Fig. 4.

Other changes are taking place meanwhile. Just behind the head two little projections appear through the skin, which soon develop into legs, which, however, are not at all employed for progression, as the tadpole wriggles its way through the water with that quick undulation of the flat tail which is so familiar to us all. The creature then bears the appearance represented in Fig. 5.

Presently another pair of legs make their appearance in front, as in Fig. 6; the tail is gradually absorbed into the body—not falling off, according to the popular belief—the branchiæ vanish, and the lungs are developed. Fig. 7 represents a young frog just before the tail is fully absorbed, and Fig. 8 shows the perfect frog.

The internal changes are as marvelous as the external. When first hatched, the young tadpole is to all intents and purposes a fish, has fish-like bones, fish-like gills, and a heart composed of only two chambers, one auricle and one ventricle. But in proportion to its age, these organs receive corresponding modifications, a third chamber for the heart being formed by the expansion of one of the large arteries,



TADPOLES IN DIFFERENT STAGES OF DEVELOPMENT.

the vessels of the branchiæ becoming gradually suppressed, and their place supplied by beautifully cellular lungs, formed by a development of certain membranous sacs that appear to be analogous to the air bladders of the fishes.

HOUSE-BUILDER MOTH.

Perhaps the most curious example of the moth family is the species which is represented in the illustration, which we take from "Wood's Natural History."

The house-builder moth is common in many parts of the West Indies, and is in some places so plentiful as to do considerable damage to the fruit trees. As soon as the larva is hatched from the egg, it sets to work in building its habitation; and even before it begins to feed, this industrious

HOUSE-BUILDER MOTH.—*Oiketicus Sanderii.*

insect begins to work. The house is made of bits of wood and leaves, bound together with silken threads secreted in the interior. When the creature is small, and the house of no great weight, it is carried nearly upright; but when it attains size and consequent weight, it lies flat and is dragged along in that attitude. The entrance of this curious habitation is so made that the sides can be drawn together, and whenever the creature feels alarmed, it pulls its cords and so secures itself from foes.

In this domicile the transformations take place, and from its aperture the male insect emerges when it has assumed its perfect form, and takes to flight. But the female behaves in a very different manner. According to the ancient maxim, she stays at home and takes care of her house, from which she never emerges, nor indeed can she emerge, as she has no external vestige of wings, and looks more like a grub than a moth; the head, thorax, and abdomen being hardly distinguishable from each other. Love and courtship with this insect are carried on quite in an Oriental fashion, pushed to extremes; for whereas the Oriental in many cases never sees the face of his veiled bride until after the nuptial ceremony is completed, the house-builder never sees his mate either before or after marriage, and so is obliged either to love blindly or not at all. Perhaps, considering the peculiar ungainliness of his spouse, he is rather fortunate than otherwise in the fate which forbids him to contemplate the charms that lie hidden behind the dense curtain that shrouds the nuptial couch, and which, but for the mystery that surrounds them, might inspire any feeling rather than that of affection.

The grub-like female is seen lying on the ground, just below the flying figure of the male insect. It will be noticed that, except for the feathered body, the creature looks more like a larva than a perfect insect. Owing to the resemblance which these remarkable insects bear to the fasces which were borne by the lictors before Roman consuls, one species has been termed the lictor moth. The Singhalese appropriately call them by a name that signifies billets of firewood, and believe that the insects were once human beings who stole firewood while on earth, and are forced to undergo an appropriate punishment in the insect state. About five species of house-builder moths are known.

Injurious Insects Killed by Fungi.

It is a well known fact that various insects are subject to the attacks of parasitic fungi which prove fatal to them. The common house fly is destroyed by one, the silkworm by another, and the pupæ of various moths by others. Two other noticeable instances of this kind were observed last season by Mr. C. H. Peck, the State Botanist, and are described as follows in his "Report to the Regents of the University of the State of New York," just issued:

It was found that the "seventeen-year locust" (*Cicada septemdecim*), which made its appearance in the Hudson River valley early in the summer, was affected by a fungus. The first specimen of this kind that I saw was taken in New Jersey, and sent to me by the Rev. R. B. Post. Examination revealed the fact that the cicadas, or "seventeen-year locusts," in this vicinity, were also affected by it. The fungus develops itself in the abdomen of the insect, and consists almost wholly of a mass of pale-yellowish or clay-colored spores, which, to the naked eye, has the appearance of a lump of whitish clay. The insects attacked by it become sluggish and averse to flight, so that they can easily be taken by hand. After a time some of the posterior rings of the abdomen fall away, revealing the fungus within. Strange as it may seem, the insect may, and sometimes does live for a time even in this condition. Though it is not killed at once, it is manifestly incapacitated for propagation, and the fungus may therefore be said to prevent to some extent the injury that would otherwise be done to the trees by these insects depositing their eggs therein. For the same reason the insects of the next generation must be less numerous than they otherwise would be, so that the fungus may be regarded as a beneficial one. In Columbia county, the disease prevailed to a considerable extent. Along the line of the railroad between Catskill and Livingston stations many dead cicadas were found, not a few of which were filled by the fungous mass. As the insect makes its appear ance only at intervals of seventeen years, and consequently will not be seen here again till 1894, it will scarcely be possible to make any further observations on it and its parasite for some time to come; yet it would be interesting to know how the fungus is propagated, or where its germs remain during the long interval between the appearance of two generations of the insect. Do the fungus germs enter the ground in the body of the larva, and slowly develop with its growth, becoming mature when it is mature, or do they remain quiescent on or near the surface of the ground, waiting to enter the body of the pupa as it emerges seventeen years hence? Or, again, is it possible that the fungus is annually developed in some closely related species as the "harvest fly" (*Cicada canicularis*), and that it passes over from its usual habitat to the seventeen year cicada whenever it has the opportunity? These questions are merely suggestive. They cannot yet be answered. A very good account of this fungus was given by Dr. Leidy, of Philadelphia, in Vol. V. of the Smithsonian Contributions, but as he bestowed no name on it, Mr. Peck has created a new genus for its reception and called it *Massospora cicadina*. The other instance of the destruction of insects by fungi is given by Mr. Peck as follows:

While in the Adirondack region, numerous clumps of alders were noticed that had their leaves nearly all skeletonized by the larva of some unknown insect. The larva were black in color and scarcely half an inch long. They were seen in countless numbers feeding upon the leaves, and threatening by their numbers, even if but half of them should come to maturity, in another year to completely defoliate the alders of that region. Upon looking under the affected bushes for the pupa of the insect, in order, if possible, to have the means of ascertaining the species, what was my astonishment to find the ground thickly flecked with little white floccose masses of mould, and that each one of these tufts of mould was the downy fungus-shroud of a

dead larva from the alders. Not a single living pupa could be found, but there were hundreds of dead and mouldy larvæ, killed without doubt by the fungus, which is nature's antidote to an over-production of this insect, and nature's agency for protecting the alders from utter destruction.

Manufacture of Menhaden Fish Guano.

The menhaden belong to the herring family, and appear on our coast in the latter part of April, and depart in November. The business of catching the fish for oil and guano has increased rapidly within the last 18 years. It is carried on from Maine to New Jersey, and is especially prominent in the northeast portion of Long Island. In 1873 there were 62 factories in operation on the coast of New York and New England, employing 383 "sailing gear" and 20 steamers, with 2,306 men ashore and afloat. Total capital then invested, $2,388,000; total catch, 1,193,100 barrels, yielding 2,214,800 gallons of oil, and 36,299 tons of guano; value of products, about $1,600,000. Since then the business has largely increased, especially in northeastern Long Island.

Mr. Edward J. Boyd, in the *Rural New-Yorker*, gives the following interesting account of the mode of converting these little fishes into guano.

Omitting here an account of the manner in which the menhaden are caught, let us begin with them when they arrive at the "fish factory," as the place where they are converted into guano is called. This is generally a two story building with a "run," which is an inclined plane supported by trestle work, upon which a dump car runs to convey the fish from the boat to the "receiving tanks." These are situated outside the factory, and from them a sliding door opens to the tanks in which the fish are boiled. These are long, water-tight uncovered boxes, having in the bottom a coil of perforated pipe for the admittance of steam for the purpose of boiling the fish, and a plug hole through which the water in which they have been boiled can be drawn off. They will each hold from 50 to 5,000 barrels of fish. In the factories south of Montauk, L. I., the fish are counted by the thousand; in those east of Montauk, by the barrel, which is supposed to contain 250, four barrels thus making a thousand fish. These fish sold during the past season for one dollar per thousand. In a certain sense the business is a monopoly, as the owners of the different factories meet every year and decide upon the price to be paid during the ensuing season.

When a steamer or "sailing gear"—the name given to sailing vessels engaged in menhaden fishing—is sighted, the preparations at the factory begin. The tanks are filled half full of salt water; the "hydraulics," or hydraulic presses used to press the fish, are supplied with water, and everything is got into "ship-shape" order. On the arrival of the vessel, the fish are loaded into the dump cars by means of "tubs." These are the barrels by means of which the fish are counted. The freighted cars are then run up to the receiving tanks and unloaded; the slide is opened, and the cooking tanks are filled; steam is admitted and the process of cooking begins. When the fish have been "cooked," so that they fall readily apart, the water is drawn off; but, instead of being thrown away, it is conducted, by means of gutters, to an oil room situated on the ground floor of the factory. When the water has all been drawn off, a slide in the end of the tank is opened, and the pomace—the name given to the cooked fish—is raked into perforated cylinders, fitted with hinged bottoms, called "curbs." When these are full, they are set under the "presses," and hydraulic pressure is applied to them. The water and oil thus forced out through the perforated "curbs" fall on the floor, which is water-tight and divided by gutters leading to the oil room. After having been cooled there, the water, owing to its greater specific gravity, settles at the bottom, and the oil floats on top, and is skimmed off, like cream from milk. The oil is then placed in vats and boiled to free it entirely from water, after which it is put into bleaching tanks, where it is clarified, and then it is barreled.

The oil and water having been pressed out, the "curbs" are run into the "scrap" house and are emptied of their contents through the hinged bottoms. The fish is now worth $10 per ton as "green scrap." In from 24 to 48 hours a fermentation takes place, which produces a darker shade, caused by the escape of ammonia, and it is then called "old scrap." The next step toward "curing" it for the farmers now takes place by removing it to the "dry works," as the factory in which the fish is dried is called. Here the first process is "picking" it. This is done by putting it through the "picker," a cylinder armed with teeth revolving against set teeth, like the cylinder of a thrasher. The fish comes from the "curbs" in hard masses that sometimes require considerable exertion to break up; but when it comes out of the picker it is very fine—completely shredded.

The next step, "drying," now begins. This is effected either by the sun or by artificial heat. In drying by means of the sun, the scrap is spread out, early in the morning, on a platform, made like a floor inclined just enough to allow any rain that may fall on it to run readily off. During the day the scrap is constantly stirred by means of a wooden harrow drawn by a horse, until four o'clock, when it is gathered by means of a "loot." This is made exactly like a sled, but with a sliding tailboard, which is held down by the driver until the space between the runners is full, when it is lifted and the scrap laid off in windrows, like hay in the field. It is next gathered into the "cure," which is simply piling it into a heap, into which perforated pipes are inserted for the purpose of conducting away the latent heat that may be developed. Next day the "cure" is "turned;" that is, merely shoveled over and made into another heap. About four "turnings" generally cool the scrap enough to fit it for shipment. It is now worth from $35 to $40 per ton to manufacturers of fertilizers.

In rainy weather, "platform curing" is, of course, impracticable; so artificial heat is employed. This is a quicker process, but by its use about one-tenth more of the scrap is lost than by sun curing. The driers are revolving cylinders, like boilers, with shelves running spirally through them. A very hot fire is built in the fire box at the front end, and the heat passes under each cylinder to the back, and then through the cylinder to the front end, where stands the smokestack. The drier is fed at the front end, and as it revolves, the scrap is carried up by means of the shelves until it reaches the top, when, the shelves being inverted, their contents fall to the bottom, to be carried up again in the same way. Every time the scrap falls it falls a little further on in the cylinders, on account of its being pitched forward a trifle at each revolution of the drier, until, finally, it passes out at the back, and down a chute, to be caught up by means of elevators and deposited in the carts placed to receive it.

The length of time it takes a charge of scrap to pass through the drier, depends upon the length of the latter and the number of times it revolves in a minute. In a 25 foot drier, revolving eight times a minute, each charge takes about half an hour to reach the back end, during which time it alternately comes in contact with the hot cylinder and the hot air in it, all its moisture being thus evaporated. Very wet scrap requires from two to five dryings before it is ready for the "cure." The moisture is carried off by means of the natural draught, and with it go the fine particles of the scrap, a loss not incurred in platform drying; although a heavy thunder shower, when the platforms are "charged"—that is, covered with scrap—will wash away many dollars' worth of it. Indeed, I have seen four or five tons of scrap washed away by a heavy rain. After the scrap passes through the driers, it undergoes the "curing" process in the same way as "platform" scrap. Green scrap is mostly used for platform drying, and is very bulky when dried. Old scrap, too, is generally placed on the platform for 12 or 24 hours, if very wet, to dry the excessive moisture, because if it were put into the driers in its soaked state, instead of drying, it would make "pills," or round, hard balls. One "dry works" can dry he scrap from several "fish factories," as the fire is kept up constantly as long as operations last or there is work to be done.

For export, the scrap is ground and bolted. For this purpose a special mill is used—the only kind of mill that will grind the scrap so that it can be drilled in with grain. It has two cylinders, with cone-shaped bearing faces. One of these makes about 2,500 revolutions per minute; and the other, which is the feeder, about 800. Marvelous is the speed with which one of these mills grinds up the scrap. I have seen two men shoveling it in as fast as they could, while a torrent of ground scrap poured out like a stream of water. Pieces of iron, or anything short of a young anchor, cannot choke its greedy throat. The ground scrap is worth from $45 to $50 per ton.

The scrap will pay for the fish and the cost of working, leaving the oil a clear profit. A thousand fish, costing $1, will yield about five gallons of oil, worth 40 cents a gallon. This oil completely fills the place of "boiled oil" in the composition of paints. Nearly all the chemical and prepared paints are mixed with fish oil. Fish guano forms the base, or principal part, of the so-called complete manures, as well as of some sorts of Peruvian guano, etc., one ton of fish guano being "worked up" into six tons of many of the fertilizers sold to farmers. Sand and clay are the chief adulterations of fish guano. These make weight. Nothing, I believe, is so rich in ammonia as fish scrap, certainly not so far as the odor it emits is an indication. In my experience, on a Sunday when the platforms were being charged with scrap six months old, the windows of a church two miles away had to be closed. Fancy how persons stand it who have to work among it. But from my own experience, I can say that the odor is never noticed by a person after he has been a week or so in the factory; but so powerful is the perfume he carries about with him, that while he remains there, he is debarred from all social relations with the outside world.

Anti-Fat.

The subject of obesity and its treatment has of late years received much attention both from doctors and their patients. The interest excited by the appearance of Mr. Banting's "Letter on Corpulence" will not be readily forgotten. The medicinal agents most commonly employed in the treatment of this condition are acids—chiefly in the form of lemon juice and vinegar—strong alkalies, and iodide of potassium. Of late, however, a preparation known as "anti-fat" has been extensively advertised, both in this country and in America, possessing, if we may accept the statements of the proprietors, very remarkable powers in removing that superabundance of fat which is so frequently a source of anxiety and discomfort to those who indulge too freely in the pleasures of the table. Anti-fat is said to be a fluid extract of *Fucus vesiculosus*, a common sea weed, known in this country as sea wrack or bladder wrack, and in France as *Chêne marin* or *Laitue marine*. It is largely employed on the coasts of Scotland and France in the preparation of kelp; while in Ireland, curiously enough, it is found to be invaluable for fattening pigs. It contains, as might be expected, large quantities of iodine, chiefly, according to Gaultier de Claubry, in the form of iodide of potassium.

Fucus vesiculosus was at one time officinal in the Dublin Pharmacopœia, and is by no means a new remedy. Pliny describes it under the name of *Quercus marina*, and says that it is useful for pains in the joints and limbs. In the eighteenth century it was largely employed by Gaubius, Aunel, Baster, and others, in the treatment of scrofula, bronchocele, and enlarged glands, and even for scirrhous tumors. Its charcoal, known as *Æthiops vegetabilis*, was used in the same class of cases. The fucus has also been found useful in skin diseases and asthma. On the discovery of iodine, in 1811, by Courtois, the salpeter manufacturer of Paris, it for a time fell into disrepute. In the year 1862 its use was revived by Professor Duchesne-Duparc, of Paris, who, while using it experimentally in the treatment of psoriasis, found that it possessed the singular property of causing the absorption of fat.

The fucus can be taken either as an infusion, made by steeping half an ounce or a small handful in a pint of boiling water, or in the form of pill or liquid extract. The dose of the infusion is about a cupful, but it is so abominably nasty that few people can be induced to take it. The pills contain each three grains of the alcoholic extract; and, to begin with, one is taken in the morning, an hour at least before breakfast, and another in the evening, about three hours after dinner. The dose is increased by a pill a day, until the patient is taking ten every morning and evening. It is directed that the ten pills should be taken *dans la même séance*, and that a greater interval should not be allowed to elapse between each pill than is necessary for the process of deglutition. The fluid extract may be given in drachm doses, and it is said that the best results are obtained when both the solid and liquid extracts are taken. In favorable cases the sufferer may expect a reduction in weight of from two to five pounds in the week. Unfortunately, however, the fucus appears to be somewhat tardy in its action, and the patient should lay in a good stock of the drug before commencing treatment. In successful cases one of the earliest effects is an excessive diuresis, and the urine is said to become covered with a film of a beautiful nacreous aspect. In one carefully recorded case the patient did not observe this, but noticed that his water was very high-colored, and that its odor was extremely offensive. The next action of the drug is usually on the bowels, and the patient has many calls to relieve himself, without, however, being able to pass anything more than a little mucus. Sometimes the feet and body exhale a peculiar fusty smell, so that the patient is a nuisance both to himself and friends. After this, as a rule, the reduction in weight takes place. Occasionally, however, the opposite effect is produced, and the patient gets stouter than ever; in fact, fucus has been recommended as an "anti-lean."

By some authorities it is stated that the fucus should be gathered at the period of fructification, about the end of June, and that it ought to be rapidly dried in the sun; while other and equally eminent authorities insist that it should be gathered only in September, and that it should be allowed to dry slowly in the shade, a high temperature, according to them, destroying its active properties. It is generally agreed, however, that the roots and stalks should be rejected, and that the fucus gathered on the west coast is superior to that of the east. We understand that as a matter of fact most of our fucus comes from Billingsgate market, it being extensively employed for packing fish.

It must be confessed that we know little or nothing of the mode of action of this remarkable drug. We are told that it "stimulates the absorbents," but that is throwing very little light on the subject. What we want is a real sound systematic study of its uses and properties, both in the physiological laboratory and at the bedside. When it has been thoroughly and carefully worked out, as so many drugs have been of late years—pilocarpine and gelsemin, for example—we shall be able to form an opinion as to its value, but at present we are quite in the dark.—*London Lancet.*

Saws.

Much depends on the hanging and lining of a saw. First, examine with a straight-edge the collars; sometimes it will be found that the iron, around where the steady pins are driven, will be raised so as to cause a bunch around the pins; if so, either file or cut it off with a sharp cold chisel. A true mandrel will help a bad saw, but a bad mandrel will soon spoil a good saw. The mandrel must be level, so to allow the saw to hang plumb, and be as tight in the boxes as it will run without heating, and little or no endwise motion. (We are aware that the latter will not agree with all sawyers' views, for sometimes endwise or lateral motion has to be given to favor a bad saw, but we are alluding to saws that are in a proper condition.) The saw should hang on the collars so as to be perfectly flat on the log side. Most saws are thickest in the center, and for this reason the fast collar attached to the mandrel must be a little concaved and the loose collar may be nearly flat. This cannot be looked after too closely, as one half the portable sawmills that are made at the present day are just the reverse, and when the saw is hung it will be found too full on the log side. When this is the case don't try to run the saw until after the fast collar has been properly turned up.

There should be great care taken to see that the saw does not bind on the pins, or that the eye does not fit too tightly on the mandrel; if it does, the least warmth of the mandrel

will be sure to cause it to expand, bind, and spring the saw. It is not expected that every saw will hang perfectly true, or all hang the same even on the same collars. Although the saws may be perfectly true, any deviation from perfection in the collars, or the saw, is multiplied as many times in the saw as the saw is larger than the collars. When a saw is found to be rounding or crooked on the log side, after fastening between the collars, loosen the nut and collars, and put a straight edge upon the log side of the saw and ascertain whether the fault is in the saw or in the collars. This should be done before it is used. Saws are often pronounced crooked when the fault is in the collars. We do not wish to be held responsible for the various shapes that bad collars may put a saw into; these imperfections may, however, be adjusted by packing writing paper between the saw and the collars.

The greatest care should be taken to keep the saw on a line with the run of the carriage. The saw should run nearly on a line with the carriage, the front of the saw inclining a little to the log, so that the back may rise without the teeth cutting or scratching the timber. A badly running carriage is ruinous to saws. The guides should be run as closely as they can without pinching the saw, so as to heat it on the rim and below the bottom of the teeth. It is not well to move the guides when the saw is warm, as the warmth may change its position. The practice of throwing water on the saw when warm is very bad, and should never be done. It may, however, be used to prevent pitch and gum from adhering to the saw—it keeps it clean and lessens the friction when used in a proper manner, and has no injurious effect on the saw. When used it should be applied on both sides, and put on when the saw is cool, near the eye, in a very small stream. The motion of the saw throws it over the surface to the verge, thereby producing the effect above mentioned.

Great care should be taken to keep the box next the saw from heating, as the heat is conveyed to the saw. The least heat in the center of the saw will make it limber and cause it to dodge. A saw that is in a proper condition should never have anything to cause friction in the eye, or on the rim, that can be avoided. The journal next the saw should not have any shoulders or collar to bear against the box, leaving everything free and clear. The mandrel can be as well and better secured with collars on the outside and inside of the opposite box.

The motion of the saw is one of the most essential things to be observed, and no one can give this too much attention. If the speed of the saw is too high, it cannot do good work, besides rendering it liable to many accidents. It generates heat in the saw, makes it touchy and limber, and it will only run and do good work on light feed, and while the teeth are in the best of order, and have a keen, sharp, cutting corner; as soon as this is gone the saw will run or dodge whenever it comes in contact with the least obstacle. And again: Too low a speed has its objections, but it is not attended with such ruinous effects upon the saw. These difficulties can be remedied to a limited extent by the hammering of the saw, but cannot be entirely overcome.

By carefully observing these rules respecting the care and attention due a circular saw, there will be labor and money saved. A circular saw is not unlike any other tool which has a great amount of work to do; it has its peculiarities, and needs to be kept in good order to do good work.—*Northwestern Lumberman.*

New Australian Railway.

A railway recently undertaken over the Mount Lofty range of hills, South Australia, will in years to come be regarded as one of the greatest engineering works at the Antipodes. However insignificant gradients of 1 in 45, and ascents of 2,000 feet may now be, any one who travels on the future line, or inspects the earthworks and tunnels as they are now being made, cannot fail to regard the line as a bold step for a small community to take. Nearly £750,000 will be spent on the 33 miles between Adelaide and Nairne. Within a trifle the railway is estimated to cost £22,000 per mile; and that, too, through a country where the cost of the land is a mere bagatelle. In some parts the expenditure will be fully £30,000 per mile, owing to the large amount of tunneling to be done and the height of the viaducts and embankments to be formed. The summit of the range will be reached in 18¾ miles from Adelaide, at a point about a mile to the west of Chafers, and at an altitude of 1,630 feet above sea level. Here a station, to be named after the range, the Mount Lofty Station, will be built. The ruling gradient, 1 in 45, will be between Government Farm and this point, and the descent from the summit to the Aldgate pump will be by a similar gradient. Powerful engines will have to be used, and they will come down to Mitcham without the aid of steam. The mountain section begins about Mitcham, and with but small exceptions the gradient is 1 in 50 until the Government Farm is approached. But in order to secure even this gradient creeks have to be crossed, steep hillsides hugged, mountains tunneled, sharp curves made, and ravines spanned by viaducts of great height.

The Largest Coastwise Steamer.

There was recently launched at Cramp's ship yard, Philadelphia, for Morgan's Louisiana and Texas Railroad and Steamship Company, the Chalmette, described as the largest coastwise vessel ever built in this country. She is 338 feet in length over all, 320 feet between perpendiculars, 42 feet beam, and 31 feet in depth. She has three decks and a cargo capacity for 8,000 bales of cotton. Her custom house measurement will exceed 3,000 tons.

With regard to machinery, she will have compound engines with high pressure cylinders 35 inches in diameter, and 70 inches diameter low pressure, with a stroke of 4½ feet. Four main boilers for 80 pounds working steam pressure. Her machinery is of an entirely new pattern. She will be provided with five independent cargo engines, two steering engines, two anchor, windlass, and capstan engines, together with quite a number of auxiliary pumping engines and pumps, and will be fully equipped for security against fire and sinking. Her appliances for handling freight are so complete that, it is claimed, only 30 hours will be required for discharging a cargo and receiving another.

Ice in the Arctic Regions.

Lieutenant Karl Weyprecht has lately given to the public an interesting work relating to ice and its metamorphoses in the Polar regions, from which the following, as given by Professor H. N. Moseley in *Nature*, is taken:

As an example of the mighty size of the Polar glaciers, the parents of the icebergs, the author cites the Humboldt glacier of Smith Sound, which, pushing itself into the sea in Smith Sound, forms an unbroken ice coast line composed of perpendicular cliffs 300 feet in height above the sea level and 60 miles in length, a single solid ice wall split only by vertical fissures. The fresh water ice is clear as crystal, and so hard that the Norwegian walrus hunters who run their small vessels in their voyages against all other ice obstacles, of whatever size, are careful not to charge even comparatively small pieces of this. This kind of ice is, however, scarce in the polar regions; it is the third kind of ice, that of salt water, or "field ice," which forms by far the greater part of floating ice, and with which the book is mainly concerned. The Tegetthoff was shut in for a year in field ice, and the author watched the incessant changes in the ice with great care throughout this period.

A simple smooth sheet of sea water ice is no sooner formed than it begins to be subjected to a variety of influences, which speedily convert its smooth expanse into a complicated rugged surface, covered with ridges, valleys, and irregularities of all kinds, render its thickness everywhere unlike, and split up with innumerable fissures. Most important among the causes of these changes are the variations of temperature to which the ice is exposed from the variation of that of the water below and the air above, and which are more or less local, and affect the ice differently wherever its thickness varies. From these differences of temperature ensue complicated strains in all directions, due to the unequal expansion and contraction of the mass, and the ice is rent by the tension; to these forces is added the pressure of surrounding ice fields, driven by the action of winds or currents; long fissures are formed, the edges of which grind together with mighty force.

After a while the edges separate, and the water between pulsates with the throbbing of the surrounding floes. Again they come together, and forced against one another with ever-increasing power, they are crushed and break up, huge blocks are piled above on the ice surface, resting at all angles upon one another, and other huge blocks are forced under the ice below. Hence the ice becomes rugged above, and by the freezing to it of the blocks forced under water, equally so below, the variation in thickness is increased, and with it the amount of strains caused by variation of temperature. The drifting snow hangs against the ridges and pinnacles on the surface, and forms banks and mounds which not only increase the effects due to temperature by protecting the areas on which they lie from change, but also by their immense weight, combined with that of the projecting ice masses by which they are formed, press down the ice which supports them, while the blocks below in other regions press it up. Throughout the mass gravity acts as a disturbant, no part being water borne at its natural level, the mass is strained, and gives way in all directions, and fresh complications ensue.

All these changes are accompanied by a noise. The unlucky prisoner in the field ice during the imposing unbroken loneliness of the long Arctic night, when the wind is calm, can hear the crackle of the snow under the stealthy tread of the polar bear at an astonishing distance, and hear what a man, speaking loud, says at 1,000 meters distance. It can, therefore, be well understood how the sound of the ice pressures must travel to his ear from enormous distances. "Sometimes," the author writes, "the noise of the ice movements was scarcely to be heard—a mere murmur—and came to our ears as does the play of the waves on a steep coast from the far far distance. Sometimes it hummed and roared closer to us, as if a whole column of heavily laden wagons were being drawn over the uneven ice surface." In the sound were combined all manner of noises caused by cracking, grinding, falling of blocks, crushing, and many other phenomena of ice life. "It is astonishing how far and how clearly every noise is conducted in the ice. The noise at the very margin of the field on which we were seemed to occur immediately at our feet. . . . If we placed our ears to the ice the sound was heard so loudly that we might have expected the ice to open under our feet the next moment. The whole dry ice covering was as a vast sounding-board. Whenever, as I lay down to sleep, I placed my ear against the dry wooden ship's side, I heard a humming and buzzing which was nothing else but the sum of all the noises which occurred in the ice at great distance from the ship."

A curious fact is described by the author, that the surface of an expanse of young salt water ice on which no snow has yet fallen is soft, so that the footstep is impressed upon its white covering as in melting snow. This is to be observed even at a temperature of —40° C. The unfrozen fluid is not water, but a concentrated solution of salt thrown out by the freezing of the ice beneath.

When summer begins, the thawing that occurs is very local and unequal. Any dark body, such as a heap of ashes, or the droppings of bears, eats its way into the snow, absorbing the rays of heat which are reflected off again by the general white surface. The bear droppings eat their way into the snow, and then into the ice, and the conical hole thus formed fills itself with water. It may, at last, eat its way right through the ice where not very thick. Thus are formed the greater part of those holes in drift ice which are usually ascribed to seals. The author never saw a seal's hole in winter.

A number of interesting experiments were made on ice phenomena. For example, on March 5, a cube of ice was sunk under the ice field to a depth of five meters. After the lapse of twenty-four hours it was found that a crust of new ice had formed itself over it about 1 cm. thick. This was caused by the low temperature of the block itself and, from a similar cause, ice crystals had formed between the edges of the hole, owing to the coldness of its walls. On March 10 very little increase in the added layer of ice on the cube was to be observed. On March 20 this newly formed ice was found to be softened, so that it was easily impressed by the finger; by April 2 it had become harder again, though porous and apparently a little increased. From thence onward the block dwindled regularly, especially on that part of its surface which was turned upward; on July 18 it was only a third of its original size; nevertheless, the hole through which it was sunk had, during the last period, become entirely closed by young ice at its lower margin. This experiment shows the loss of ice from below by the action of the warmth of the water. The author concludes from his experiments and measurements that compact salt water ice can never attain a greater thickness than 10 meters.

Icebergs are subjected to disintegration after somewhat the same manner as rocks so commonly are. They are full of crevasses, into which the water formed by melting penetrates; in winter this water freezes, and by its expansion all through the glacier a rupture of the mass ensues. "It is highly probable that most of the icebergs afloat in winter are in such a condition that a very slight cause is sufficient to make them burst because of their state of internal tension. . . . Every polar traveler can tell how a shot, the driving in of an ice anchor, or any other sudden vibration, has brought about the catastrophe; cases have even occurred in which the sound of the voice alone was sufficient. An iceberg is always an unpleasant neighbor." So many are the causes which tend to destroy icebergs that the author concludes "no berg exists which could withstand them more than ten years, and that commonly the life of a berg is much shorter." However this may be, doubtless the much larger Antarctic bergs last very much longer, as must necessarily occur because of the much greater uniformity of the climate to which they are exposed.

With regard to glaciers, the author quotes an interesting observation of Kane's to the effect that even in lat. 78° 20' during the entire winter, however low be the temperature, the glacier streams never dry up. The melting which supplies them with water can only derive its requisite heat from the friction of the ice masses.

The chapter on the ice movements is full of interest Every field acted on by winds and currents has its own peculiar velocity, depending on the dimensions of the irregularities above and those of the resistances below, in which no two fields are alike. From these differences of velocity arise the irresistible pressures between contiguous fields. The iceberg deeply sunk drifts but slowly, while the ice field may travel very fast. If the field catches up a berg in its course, it is broken and torn by the berg; and as it proceeds on its course its broken fragments are piled up block upon block on the coast of the iceberg. To a casual observer it appears as if the iceberg, driven by a counter current below, were being forced in the opposite direction to the ice field, so as to plow it up. Many groundless accounts of the existence of such counter currents thus observed have been circulated.

Another cause of pressure between ice fields is that, owing to the irregularities on their surfaces, they are twisted round by the action of the wind, which takes hold more on some regions than others. Every field is differently thus acted upon for each direction of the wind. A similar effect is caused by the currents beneath acting upon the irregularities of the under surface. So various are the movements in the ice fields that even when the ice lies all the while closed, it is very seldom that any two pieces remain for any length of time in the same position alongside one another. Two ships beset together by the ice are sure sooner or later to be separated.

Charleston's Great Fire of 1861.

Mr. Wm. L. King, of Charleston, S. C., calls attention to an omission from the list of great fires, given in our issue of October 25. The most extensive conflagration from which Charleston has suffered occurred in 1861. It was the work of an incendiary, and swept over 540 acres of ground. There were 358 sufferers, many of them having more than one house destroyed.

RECENT DECISIONS RELATING TO PATENTS, TRADE MARKS, ETC.

By the U. S. Circuit Court.—Southern District of New York.

LICENSEES—NELSON *v.* MCMANN *et al.*—ELASTIC PACKING FOR JOINTS.

1. A party who, at best, is but a mere licensee cannot maintain an action for infringement in his own name.

2. The distinction between patentees, assignees, grantees of exclusive rights, and licensees, made by the law of 1836, and thereafter defined by the courts, has not been changed by the act of 1870. A licensee cannot sue alone in his own name.

By the U. S. Circuit Court—District of Connecticut.

HICKS *v.* MÖLLER.—BOTTLE STOPPER.

The patent (No. 48,300) granted to E. D. Moyer, June 20, 1865, for improvement for bottle stoppers, is not infringed by the device patented (reissue) to C. De Quillfeldt, June 5, 1877, the two devices being substantially different in construction and mode of operation.

By the U. S. Circuit Court—Northern District of New York.

GARRETSON *v.* CLARK *et al.*

1. Where the entire value of the whole machine as a marketable article is properly and legally attributable to the patented features, the profits may be estimated by showing the profits derived from making and selling the article containing the patented features and the profits realized from the manufacture and sale of other forms of the same article not embodying the patented features.

2. The burden is on the plaintiff to lay a basis by evidence for ascertaining the proper profits or damages, and it is not the province of the master, nor of the court, to suggest any specific line of proof as proper or necessary.

By the Commissioner of Patents.

TRADE MARK.

The term "Masonic" is not registrable as a trade-mark for cigars.

Although the noun from which this adjective was formed is old in our language, the adjective itself seems to have been contributed to the language by the order to which it applies, and its only meaning is "pertaining to the craft or mysteries of Freemasonry." Applied as a trade-mark to cigars it would be descriptive of the cigars, connecting them in origin, or use, or adaptation, with the Masonic order. The words Presbyterian, Methodist, or Roman Catholic, used as trade-marks for cigars, would stand on the same footing. Such words are not registrable as trade-marks.

TRADE-MARK.

The words "Granulated Dirt-Killer Soap" are registrable as a label, but not as a trade mark, for soap.

The word "dirt-killer" appears to be decidedly suggestive of a quality of the commodity to which the label is to be applied. In my judgment the registration of the words "Granulated Dirt-Killer Soap" as a trade-mark for soap might well be refused by the examiner, on the ground that the words are descriptive of the soap.

TRADE-MARK.

The name "Bob Ingersoll," associated with the representation of the bust and head of a man, is registrable as a trade-mark for cigars, Mr. Ingersoll having filed his consent, in writing, to the registration.

ALLEGATION OF EXAMINER.—HILL—TOY.

1. The applicant's affidavit is *prima facie* proof not only that he is an original inventor, and believes himself to be the first inventor, but also that he is the first inventor.

2. The mere allegation by the examiner that an invention has long been known and used in public, is not evidence of lack of novelty. It must be supported by affidavit, as provided in the rule of April 12, 1879.

BURGESS *v.* WETMORE.—MAGAZINE FIREARMS.

1. As against a prior applicant who had reduced the invention to practice before his application was filed, it is necessary for a subsequent applicant to show not only priority of conception and diligence in the prosecution of invention, but also a lawful reduction to practice.

2. A concession of priority is, under the rules, binding upon the parties to the concession, and also upon all the parties to the interference. But the rule goes no farther. It permits no party, by a concession, to fix the date of the invention of another party as against a third party to the interference. It renders no statement of foreign matter introduced into the concession legal evidence against anybody except the persons who make them.

3. The reduction of an invention to practice by a person who is not the inventor, nor the agent of the inventor, even though he may have derived his knowledge of the invention from him, is not equivalent to a reduction to practice by the inventor himself. The law accords the patent to the later applicant who connects by due diligence a prior conception, not with a reduction to practice by some one else, but with a reduction in practice by himself or his agent.

EX PARTE WINTHERLICH *et al.*—PROCESS OF MAKING DROP-SHOT.

1. A machine and its product cannot be joined in one application when they constitute different inventions; but when, being inseparable in their nature, they constitute one and the same invention, they may be so joined.

2. The applicant cannot be required to suggest considerations or proofs which shall establish these relations between the machine and the product beyond the possibility of reasonable doubt. It is enough if the reasons on which he bases his claim that the two are inseparable overbalance the opposing reasons in the judgment of the tribunals having jurisdiction of the case.

3. These reasons may be suggested by the laws of nature or by the testimony of witnesses. In cases of evident conflict between the two, the former must, of course, prevail.

EX PARTE CARTER.—MANUFACTURE OF RAKES.

1. In an application for a process patent every stage or sub-process distinctly claimed, which is capable of illustration by drawing, must be illustrated; but it is not, in general, necessary to illustrate by drawings the several steps in each stage of a sub-process claimed.

2. Where the applicant claims as a single sub-process the bending of the shank of a rake and the finishing of the shoulder at the junction of the shank and rake head, it is not necessary for him to illustrate, by drawing, the blanks with the shank bent but not compressed or finished about the head.

3. If a drawing of dies used in a sub-process can fairly be regarded as essential to such a description of the sub-process as will enable those skilled in the art to practice the invention, then a drawing must be furnished, although novelty in the construction of the dies may not be claimed.

EX PARTE DINKELBIHLER.—BRUSHES.

A claim for a rotary brush, with handles at right angles to each other connected by a frame, cannot be joined with a claim for a rotary brush with handles at the opposite ends of its axis, for the two sets of handles do not co-operate with each other, nor are they used either simultaneously or successively in the accomplishment of any result.

ACTIENGESELLSCHAFT APOLLINARIS-BRUNNEN *v.* SARATOGA SELTZER SPRING CO.—MOTION TO REOPEN INTERFERENCE.

1. The effect of sections 1,750 and 4,905 of the Revised Statutes is to authorize the Commissioner of Patents to establish rules for taking depositions before United States consuls in foreign countries. There is no other authority for taking depositions in interference cases. These statutory provisions do not execute themselves, nor provide for their own execution otherwise than through rules to be established by the Commissioner.

2. The rules for taking depositions in interference cases, now in force, do not apply to foreign countries.

MECHANICAL INVENTIONS.

An improvement in pitman connections, patented by Mr. Samuel Shiflett, of North River, Va., is especially adapted for use in connection with machinery for harvesting, where the reciprocation is rapid and frequent oiling is required; and it is also applicable to all kinds of machinery where a pitman or connecting-rod is made use of.

An improvement in washing machines has been patented by Mr. James Carroll, of San Francisco, Cal. The object of this invention is to provide a machine for washing clothes of all descriptions, but especially adapted for woolen clothes, because it will wash them without shrinking them.

An improvement in railway water-tanks has been patented by Mr. John D. Craig, of Vienna, Ill. The objects of the improvements are to prevent the freezing of the water in the tank from affecting the valve-stem and valve, and causing leakage and the consequent freezing and choking of the outlet-pipe; to prevent the bouncing and dancing of the valve when closed by the formation of a vacuum when the water is shut off; to adapt the outlet-pipe to the admission of the valve-stem, and to provide a hinged coupling for the extension of the outlet-pipe.

Mr. William H. Pilliner, of Elko, Nev., has patented a gold-washer and amalgamator of simple construction, designed for the purpose of obtaining gold, either in the wet or dry way, from the ores containing it. In this washer the particles of gold are rubbed into the quicksilver by the revolutions of a cylinder. A forcible contact is secured which must of itself very considerably increase the percentage of amalgamation, while the much longer exposure of the gold to the mercury, which is possible in this washer, adds still more to its advantage.

Mr. John E. Freeman, of Herkimer, N. Y., has patented an improvement in steam generators or boilers, which is so constructed that the steam will be generated very rapidly, and at the same time less fuel will be required than with boilers of the ordinary construction. It consists in the combination of cocks with the tubes connecting the tubes that form the vertical walls of the fire-chamber with the water-receiving chamber, and placed below the level of the fire-chamber, so as to be away from the heat.

Mr. Daniel Hubbard, of Oswego, N. Y., has patented a reaction turbine wheel, in which the wheel is surmounted by an air-chamber, and is set on the outside of a scroll-shaped flume that has a central aperture, through which the water is delivered into a corresponding central aperture in the wheel.

Messrs. Montague M. McGregor and James C. Croxton, of Rockwall, Texas, have patented an improved traction-engine for hauling freight upon roads and in other places, and for driving various kinds of light machinery. It is so constructed that the boiler will be held in a vertical position, whatever be the grade of the roadway, and that will cut off steam instantly at any desired point of the piston-stroke.

What We are Doing.

Probably never in the history of the world have mechanical invention and scientific discovery been brought to bear so universally and effectually to cheapen and improve the products of industry as in the past ten years. Especially has this been the case in this country, until, with our manifold labor-saving appliances, we have been enabled to place our wares in all the leading markets of the world, competing favorably with the poorly-paid and cheap hand-labor of the older countries. The iron and steel industries are wonderful examples of the progress made, every step, from taking the ores from the mine to the finished product in tool or machine, being cheapened by labor-saving inventions; while science comes in to utilize what was formerly considered worthless and magnify results in increased values.

Blast furnaces now turn out double the product of former years without increasing the size, and from many parts of the country we have been told that iron was made at from $11 to $14 per ton. Considering these facts, and the facilities now known of utilizing our abundant lean and cold short ores, many of our conservative and solid manufacturers look with alarm upon the persistent efforts of some of our dealers to "talk up" prices and urge a yet greater advance. If pig iron can be made for $14 per ton, or even at $16, it is thought that it would be best for the interests of trade that the prices ruling for the past few weeks should not continue. The price of iron, like the price of bread, touches vitally so many industrial interests of the world that an advance of from 75 to over 100 per cent, in the face of great reductions in the cost, cannot but react in disaster.—*American Manufacturer and Iron World.*

A Bridge of Old Rails.

The *Engineering News* states that a new iron bridge to carry the carriage road over the railway at the Intercolonial station, St. Johns, N. B., is, with the exception of the hand railing, which is made of cast-iron posts and gas-pipe, built entirely of old rail. The trusses are of the form known as the "bow-string." There are two roadways, each 13 feet wide, with sidewalks outside of trusses, each 5 feet wide, protected with iron hand-railing. The top chords of the outside trusses consist of two large T rails (weighing 70 lb. to the yard), and the bottom chord of two U rails, weighing 56 pounds to the yard. The center truss consists of three large T rails on top, and three U rails in the bottom chord. The diagonals between chords are U rails secured to chords with a wrought-iron fastening, riveted into the U, surged down and fitted with bolt and nut. The floor beams are made of T rails, riveted flange to flange, and secured to chords with angle iron. The floor consists of longitudinal floor timbers, covered transversely with three inch planks.

Air as a Stimulant.

The exciting and stimulating properties of pure oxygen are well known, and every one has felt the invigorating influence of fresh air, yet no practical application has been made of these beneficial properties of a substance so cheap and universal. When the body is weak, the brain fatigued, and the whole system in a state of lassitude, just go into the open air, take a few vigorous inspirations and expirations, and the effect will be instantly perceived. The individual trying the experiment will feel invigorated and stimulated, the blood will course with freshness, the lungs will work with increased activity, the whole frame will feel revivified, and nature's stimulant will be found the best.

Fever and Ague.

There are some situations where fever and ague prevails every season, and this is the case in the vicinity of creeks and swamps. An acquaintance of ours, who has resided for several years on one of these creeks, never has had a single case of fever and ague in his family, while all his neighbors have been more or less affected with it every season. He attributes his immunity from this troublesome disease to the use of a good fire in his house every chilly and damp night in summer and fall. When the Indians travel at night or early in the morning in swampy regions they cover their nose and mouth with some part of their garments to warm the air which they inhale, and this they say prevents chills and fevers.

New Method of Testing Milk.

In the *Chemiker Zeitung* we find the following method, invented by Mr. Ohm, of testing and examining milk without the use of any instruments.

About one ounce of good pulverized gypsum is mixed with a sufficient quantity of the milk that is to be tested to the consistency of a paste. By attentively watching the time that this paste requires to congeal or become set, the quality of the milk can be determined. If the milk has a specific gravity of 1,030 at 60° Fah., the mass will congeal in 10 hours, with 25 per cent of water in 2 hours, with 50 per cent of water in 1½ hours, and with 75 per cent of water in about 40 minutes.

The above results are confirmed by Prof. Reichardt, who will make further experiments to fully establish the accuracy of the above method.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 30,000 copies every weekly issue.*

Wanted—A good second-hand lathe to swing eight feet. Address Stephen W. Baldwin, 96 Liberty St., New York, giving general dimensions, weight, price, and other particulars.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien M'f'rs, 23d St., above Race, Phila., Pa.

Surveying Instruments. G. S. Woolman, 116 Fulton St., N. Y.

The New Domestic Bible, with its 2,000 illustrations, is said to be a marvel of beauty and usefulness. A beautiful present for a friend or relative. Subscribers desiring a copy of the Holy Bible should consult the advertiser's special offer in this issue.

See Staples & Co.'s advertisement of Non-Congealable Lubricating Oils on inside page.

Nellis' Cast Tool Steel, Castings from which our specialty is Plow Shares. Also all kinds agricultural steels and ornamental fencings. Nellis, Shriver & Co., Pittsburg, Pa.

Metallic Articles Colored in Single or Rainbow Colors. New Process. High cost metals imitated in cheaper metals. Gardiner M'f'g Co., Newburyport, Mass.

Hearing Restored.—Great invention by one who was deaf for 20 years. Send stamp for particulars. Jno. Garmore, 60 E. Sixth St., Cincinnati, O.

The Paragon School Desk and Garretson's Extension Table Slide manufactured by Buffalo Hardware Co.

For Superior Steam Heat. Appar., see adv., page 334.

Frank Miller's Leather Preservative and Waterproof Oil Blacking has no equal for softening, preserving, and rendering impervious to water, all kinds of leather.

Frank Miller's Original and Genuine Prepared Harness Oil Blacking contains no coal or mineral oils.

Shafting, etc.; specialty. P. Pryibil, 467 W. 40th, N. Y.

Perfection at last! Who will buy a Rotary Shuttle Sewing Machine? J. J. Green, Boonton, N. J.

Large Stock New and Second-hand Engines, Boilers, and Wood-working Machinery. Specify what is required. Belcher & Bagnall, 40 Cortlandt St., New York.

Power Hammers. P. S. Justice, Philadelphia, Pa.

Steel Castings, solid; act same as bar steel; Plow Shares; Crank Shafts; Dies; Hammer Heads; Pinions; Wheels; Cross Heads. All articles difficult to forge. Agricultural Wrought Steels. Read, McKee & Co., limited, Pittsburg, Pa.

For best Fixtures to run Sewing Machines by Power, address Jos. A. Sawyer & Son, Worcester, Mass.

Thomas D. Stetson, 23 Murray St., New York, serves as Expert in Patent Suits.

The Baker Blower ventilates silver mines 2,000 feet deep. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Wheelbarrows.—The "A. B. C. bolted" will outlast five ordinary barrows. $24 per doz. A. B. Cohn, 197 Water St., N. Y.

Park Benjamin's Expert Office, Box 1009, N. Y. Recipes and information on all industrial processes.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

To Capitalists, Steam Fitters, Founders, etc.—Patent right for sale of new Steam Heat Radiator. Address, for particulars, J. N. Farnham, Waltham, Mass.

Steam Traps; best and cheapest in use. No blowing through to start. T. Sault, New Haven, Conn.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts. Importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

The Secret Key to Health.—The Science of Life, or Self-Preservation. 300 pages. Price, only $1. Contains fifty valuable prescriptions, either one of which is worth more than ten times the price of the book. Illustrated sample sent on receipt of 6 cents for postage. Address Dr. W. H. Parker, 4 Bulfinch St., Boston, Mass.

Brass or Iron Gears; list free. G. B. Grant, Boston.

The Friction Clutch that is doing work in many places satisfactorily, that has never been done by any other, can be seen at Institute Fair, New York. D. Frisbie & Co., New Haven, Conn.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Wood-Working Mach'y. P. Pryibil, 467 W. 40th, N. Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Steam Excavators. J. Souther & Co., 12 P.O. Sq. Boston.

Bradley's cushioned helve hammers. See illus. ad. p. 302.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 235, Jersey City, N. J.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels.—The Solid Original Emery Wheel.—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery. Send for descriptive catalogue to Rowley & Hermance, Williamsport, Pa.

Portable Railroad Sugar Mills, Engines and Boilers. Atlantic Steam Engine Works, Brooklyn, N. Y.

Silent Injector, Blower, and Exhauster. See adv. p. 334.

Planing and Matching Machines, Band and Scroll Saws, Universal Wood-workers, Universal Hand Jointers, Shaping, Sand-papering Machines, etc., manuf'd by Bentel, Margedant & Co., Hamilton, Ohio. "Illustrated History of Progress made in Wood-working Machinery," sent free.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Eclipse Portable Engine. See illustrated adv., p. 318.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

All makes and sizes of Steam Hammers bored out. L. B. Flanders Machine Works, Philadelphia, Pa.

Cut Gears for Models, etc. (list free). Models, working machinery, experimental work, tools, etc., to order. D. Gilbert & Son, 212 Chester St., Philadelphia, Pa.

Valve Refitting Machine. See adv., page 269.

Blake's Belt Studs. The strongest, cheapest, and best fastening for all belts. Greene, Tweed & Co., New York.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of this week.

The E. Horton & Son Co., Windsor Locks, Conn., manufacture the Sweetland Improved Horton Chuck.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 269.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

For Reliable Emery Wheels and Machines, address The Lehigh Valley Emery Wheel Co., Weissport, Pa.

Pays well on small investments; Magic Lanterns and Stereopticons of all kinds and prices; views illustrating every subject for *public exhibition and parlor entertainments*. Send stamp for 80 page Illustrated Catalogue. Centennial medal. McAllister, 49 Nassau St., New York.

Rubber Belting, Packing, Hose, and all kinds of manufacturers' supplies. Greene, Tweed & Co., 18 Park Pl., N. Y.

Patent Steam Boiler Damper Regulator; most reliable and sensitive made. National Iron Works, New Brunswick, N. J.

Deoxidized Bronze. Patent for machine and engine journals. Philadelphia Smelting Co., Phila., Pa.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Circulars on application. Pittsburg Steel Casting Company, Pittsburg, Pa.

The New Economizer, the only Agricultural Engine with return flue boiler in use. See adv. of Porter Mfg. Co., page 270.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

For Pulley Blocks, write Block Works, Lockport, N. Y.

NEW BOOKS AND PUBLICATIONS.

A PRACTICAL TREATISE ON NATURAL AND ARTIFICIAL CONCRETE. By Henry Reid. New York: E. & F. N. Spon. 8vo, cl., pp. 384.

A third and enlarged edition of Mr. Reid's well-known work. The author traces historically the uses of concrete in architecture, discusses the nature of concrete, matrices, aggregates, stone breakers, and other machinery for reducing the aggregates, the treatment of aggregates, the silicating process, the established processes of concrete manufacture, English concrete industries, constructive concrete applications, important engineering concrete works, German Portland cement, the character of building materials, bastard mortar, a great variety of original experiments on concretes, etc. In the chapter on important engineering concrete works, it appears that the huge 70-ton blocks used on the Mississippi jetties are far from being the largest yet employed. In the works of the river Liffey improvement at Dublin, Ireland, concrete blocks weighing 350 tons each were successfully handled.

LECTURES ON ELECTRICITY IN ITS RELATIONS TO MEDICINE AND SURGERY. By A. D. Rockwell, A.M., M.D. New York: Wm. Wood & Co. 8vo, cl., pp. 99. Price $1.00.

Seven lectures on the theory and practice of electro-therapeutics, reprinted from the *Virginia Medical Monthly*. The ground covered embraces electro-physics, electro-physiology, electro-diagnosis, methods of application, apparatus for electro-therapeutics, the treatment of special diseases, and electro-surgery. The value of Dr. Rockwell's investigations in this department have been widely recognized by the profession, not only for their effect in extending the bounds of scientific knowledge, but in helping to reclaim from quackery an important department of medical study and practice.

COPYRIGHT AND PATENTS FOR INVENTIONS. Compiled by R. A. Macfie. Edinburgh: T. & T. Clark. Vol. I. 8vo, paper, pp. 406.

Contains an essay on the origin and progress of literary property written by Lord Dreghorn, nearly a century ago; evidence given to the late royal commission on copyright in favor of royalty republishing; and a large quantity of extracts, notes, and tables intended to further the national and international adoption of the royalty copyright system. The compiler is one of those zealous but belated individuals to whom the inevitable tendencies of civilization are a perpetual grievance. The increasing recognition of property-right in ideas, more particularly in invention, is Mr. Macfie's especial bugbear; and his persistent efforts to stay the course of modern thought and practice in this direction forcibly remind one of Mrs. Partington's attempts to sweep back the tide. His book contains much interesting though undigested matter, and is copiously indexed.

KING'S POCKET BOOK OF CINCINNATI. Edited and published by Moses King. Harvard College, Cambridge, Mass. Cloth, 35 cents; paper, 15 cents.

A particularly well made, handy, and useful account of Ohio's chief city. The information is well chosen and well put; and it is abundant.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) D. A.—The use of phosphorus alone in any form will not serve to stimulate memory, and we cannot advise its use in the way suggested. An active life in the open air in an occupation requiring the constant employment of the mental faculties, a temperate diet, and the avoidance of excess of any kind are among the best remedies.

(2) W. H. R. asks: 1. What is meant by a battery polarizing? A. When liquids are brought into direct contact with metals, and included in a galvanic circuit, they become decomposed by the action of the current, and this effect takes place even when the action is no longer visible to the eye. The component parts of the liquids, or, in other words, the products of decomposition, collect upon and cover the metallic surfaces which border the stratum of liquid, and thus a new electric difference or electromotive force arises between the metals, which tends to oppose the original electromotive force of the battery. Metals which are thus affected in respect to their electromotive force are said to be polarized, and the process is called galvanic polarization. 2. Will common sheet zinc melted and cast into a thick plate do for use in batteries? A. Yes, but the pure article is much better. Pure zinc may be obtained from metal dealers in this city. 3. What is the cartridge paper used in making an induction coil? A. It is tough manila paper well calendered. Any smooth, strong paper will answer the same purpose. 4. Where can carbon be obtained? A. From electricians who advertise in our columns.

(3) D. J. E. writes. Please be good enough to decide a question by answering the following question: What is a miter? One party holds that the intersection of parallel lines at any angle is termed a miter. The other party claims the term miter can be only properly applied to the intersection of parallel lines at an angle of 45 degrees. A. Webster's dictionary says a miter "in architecture is an angle of 45°," and also that anything mitered is "cut or joined at an angle of 45°."

(4) J. B. B. asks for directions for polishing a horn to be used as a powder horn. A. Scrape the horn with a glass or steel scraper, then smooth with pumice stone and water applied with a piece of leather; then use rotten stone and water applied with a piece of canton flannel; finally apply whiting and water with a piece of canton flannel.

(5) A. G. asks how to silver plaster casts. A. Ordinary plaster models are covered with a thin coat of mica powder, which perfectly replaces the ordinary metallic substances. The mica plates are first cleaned and bleached by fire, boiled in hydrochloric acid, and washed and dried. The material is then finely powdered, sifted, and mingled with collodion, which serves as a vehicle for applying the compound with a paint brush. The objects thus prepared can be washed in water, and are not liable to be injured by sulphureted acids or dust. The collodion adheres perfectly to glass, porcelain, wood, metal, or papier mache.

(6) C. E. asks how to enamel iron hollow ware. A. The enamel of iron hollow ware is made of powdered flints ground with calcined borax, fine clay, and a little feldspar. This mixture is made into a paste with water, and brushed over the pots after they have been scoured with diluted sulphuric acid and rinsed clean with water. While still moist they are dusted over with a glaze composed of feldspar, carbonate of sodium, borax, and a little oxide of tin. Thus prepared, the pots are gradually dried, and then the glaze is fired or fused under a muffle at a bright red heat. Oxide of lead, although increasing the fusibility of the glaze, impairs its efficiency, as it will not resist the action of acids in cooking.

[OFFICIAL.]

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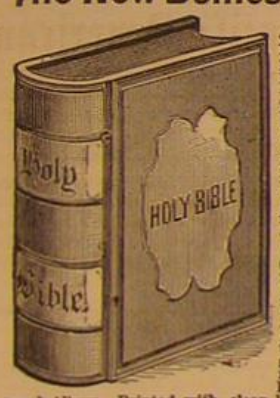

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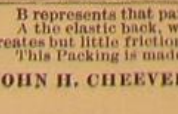

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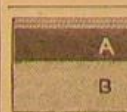

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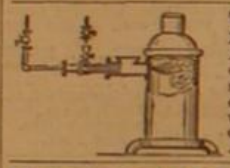

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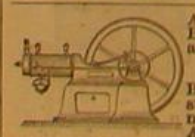

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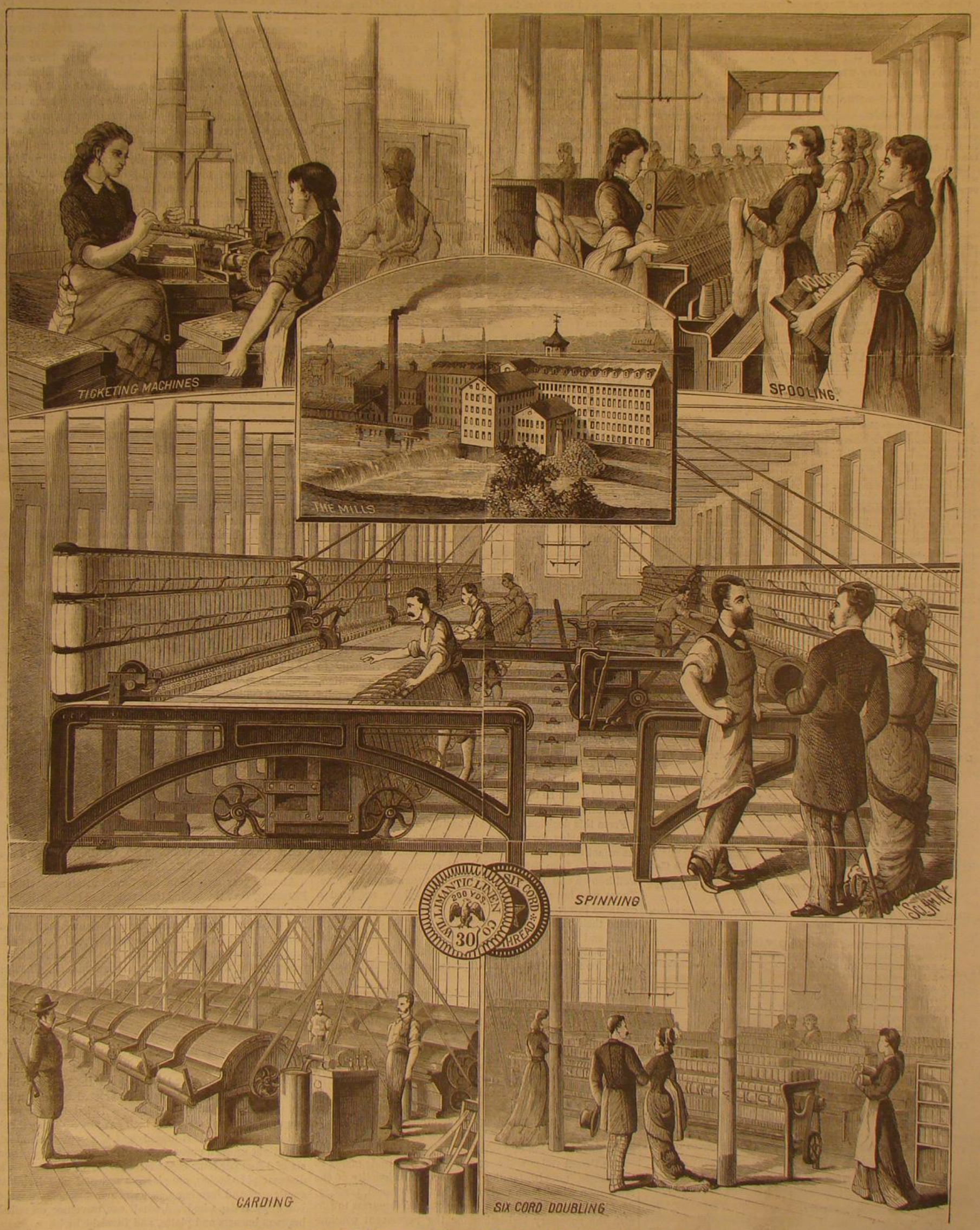

MILLS OF THE WILLIMANTIC LINEN COMPANY.—[See page 357.]

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Phylloxera.
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VII.—ARCHÆOLOGY.—New Explorations of the Ruins at Palenque, Mexico. By M. F. MALER. 2 figures.

THE TRADE MARK DECISION.

The three cases of the United States against Emil Steffens, Adolph Witteman, and W. W. Johnson—all prosecutions for violations of the trade mark laws embodied in sections 4,937 to 4,947 of the Revised Statutes—were decided by Justice Miller in the United States Supreme Court, at Washington, November 17. The lower courts had been divided in opinion as to the constitutional power of Congress to legislate on this subject. It was maintained by counsel who sought an affirmative answer to the question that two clauses in the Federal Constitution furnish sufficient warrant for the legislation in dispute, namely, the 8th clause of section 8, article 1, which provides that Congress shall have power to pass laws to promote the progress of science and the useful arts by securing for limited times to authors and inventors the exclusive right to their inventions and discoveries; and the third clause of the same section, empowering Congress to regulate commerce between the States and with foreign nations. The court declared the attempt to identify trade marks with works of authorship and invention to be surrounded by insurmountable difficulties. If the symbol, however plain, simple, old, or well-known, had been first applied by a claimant as his distinctive trade mark, he could by registrations secure the right to its exclusive use. While such legislation might be a judicious aid to common law on the subject of trade marks, and within the competency of legislatures whose general owners embraced that class of subjects, the court was unable to find any such power in the constitutional provision concerning authors and inventors.

With regard to the argument that a trade mark is used to identify a particular class or quality of goods, and that as so used it is a valuable aid or instrument of commerce, and comes within the scope of the constitutional provison cited, the court held that the clause quoted does not bring within the control of Congress every species of property which is the subject of commerce, or which is used in commerce (Wallace *vs.* Louisiana, 8 How. 73; Paul *vs.* Virginia, 8 Wall. 168), and that the legislation in question did not limit the use of trade marks to inter-state or international commerce, as it should do if based on the constitution or provision quoted in its support. If it referred to all trade and to commerce between all points, it was obviously an exercise of power not conferred upon Congress. That this was the purpose of the legislation in question seemed, in the opinion of the court, to be evident. It contemplated the establishment of a universal system of trade mark registration for the benefit of all who had already used a trade mark, or who wished to adopt one without regard to the character of the trade to which it was to be applied or to the locality of owner. Such legislation was, in the opinion of the court, in the excess of Congressional power. It had been urged that if Congress had power to regulate trade marks used in commerce with other nations and among the several States, its legislation, so far as it related to that class of cases, should be held valid; but to this the court held two objections: First, that there was nothing to show that the trade marks in the three causes under consideration were used in that kind of commerce; and, second, that it was not within judicial province to give the words used by Congress a narrower meaning than they were manifestly intended to bear. To do so would be virtually to make a law which would be only partial in its operation, and which would complicate rights which parties would hold in some instances under acts of Congress and in others under State law. The question of the treaty-making power of the General Government over trade marks, and the duty of Congress to pass any laws necessary to carry such treaties into effect, was left untouched. The only question in the three cases under review was whether the statutes of 1870 and 1876 could be upheld in whole or in part as valid and constitutional, and that the court answered in the negative.

From this decision many have hastily inferred that no protection remains for the property rights of merchants and manufacturers in trade marks, and no means of preventing the markets from being flooded with spurious wares bearing well-known and respected labels. But such is not the case Those who have been using trade marks have acquired a common law right to them; and in case they are counterfeited their owners can at once bring suit at equity to restrain and to recover damages in the courts of any and every State where the infringement occurs; or in the United States courts in case the litigants are citizens of different States.

The advantages of the laws which have been declared unconstitutional lay simply in their enabling all suits for infringements of trade marks to be brought in United States courts, and in providing for a formal registration of trade marks by the Patent Office, the certificate of which was accepted in all the courts of the country as prima facie evidence of ownership. Another advantage of such registration arose from the facility it afforded for determining whether a desired trade mark had been previously adopted by another, thus preventing unintentional infringements.

It is proper to add that this decision does not in any way affect the protection of trade labels by copyright.

The Patent Office will continue to register trade marks as heretofore, notwithstanding the unconstitutionality of the laws upon which such registration has been based, trusting, doubtless, to prompt action on the part of Congress to furnish the necessary legislation for the permanent continuance of the work. Should this fail, Congress will no doubt provide by appropriate legislation the means for returning the fees received for the 8,000 or more trade marks thus far registered.

A WESTERN TOW-BOAT.

The Pittsburg coal firm of W. H. Brown & Co. have just completed and added to their fleet of tow-boats the Harry Brown, a typical Western river tow-boat, being the most powerful and complete high pressure craft of its kind afloat. The peculiar and hazardous conditions which attend the safe delivery at New Orleans of a "tow" (from 200,000 to 500,000 bushels) of Pittsburg coal cannot be fully shown here, nor are they likely to be clearly comprehended by any but river men. The first 500 miles below Pittsburg comprises a succession of tortuous windings, of shoals and "riffles," and bars and counter-currents. To successfully run this gauntlet with a cumbersome, deeply laden tow, containing tens of thousands of tons of coal, boats of the Harry Brown type are required, with light draught and enormous steering as well as propelling power. Their pilots must have absolute control over a rigid mass that often takes up all the available water in the channel, both as to width and depth. To render this possible the Western river man places his boat behind his fleet of coal-laden boats and barges, and by means of great hawsers binds the whole mass of a score of craft into a solid "tow."

On the Ohio and Mississippi rivers the Hudson River or canal system of towage would be utterly useless. Hence in the Harry Brown's construction features unintelligible to Eastern boatmen may be noted. Her dimensions are as follows: Length on deck, 210 feet; beam, 42 feet, over all, 52 feet; hold, 5½ feet. Engines, one pair, high pressure. 26 and $\frac{8}{10}$ diameter of cylinders, 10 feet stroke. Seven steel boilers, 40 inches diameter and 28 feet long, furnish the necessary steam, at 170 pounds pressure, test pressure of boilers being 260 pounds hydraulic. An auxiliary or "nigger" boiler, 38 inches by 10 feet, supplies steam for engines operating capstans, etc. The wheel, located at the stern of the boat, is 26 feet 4 inches in diameter, length of buckets, 32 feet, each bucket or paddle being 32 inches in width. The wheel shaft, upon which the greatest strain is brought to bear, and upon which the safety of boat and tow depends, is a special feature of the Harry Brown, being the first wrought steel shaft ever imported and used upon a river tow-boat. It is of crucible steel, from the works of Krupp, at Essen, and weighs alone 20,600 pounds; with flanges, etc., 40,000 pounds; and cost 13 cents per pound delivered in New York. Its dimensions are: Length, 36 feet 7 inches; diameter at journals, 13 inches; in center, 15 inches. Rudders, four in number; one pair, balanced, 25 feet long; one pair, wing, 14½ feet long; actuated by steering wheel, 12½ feet in diameter, with 16 inch barrel.

Ready for business the Brown draws only 3 feet 4 inches forward and 3 feet aft, a great desideratum, enabling her to return to port during a season of low water. In service, and to maintain steam at 170 pounds, the boilers will evaporate 5,000 gallons of water per hour, and the engines evolve 1,750 horse power. This boat, with a favorable stage of water—9 to 12 feet at Pittsburg—is expected to take to New Orleans and other Southern ports from 28 to 30 loaded coal boats, say 600,000 bushels, or the total output of 6 acres of a 4½ foot vein of Pittsburg coal. Such a tow measures 850 by 200 feet, and reduced to tons of 2,000 pounds, contains 22,800 tons. A loaded coal boat draws from 7½ to 8 feet, a barge from 6 to 7 feet. The former's load is 23,000 to 25,000 bushels, the latter 12,000 to 13,000 bushels.

In the Harry Brown is embodied every feature that long experience could suggest or money procure to make her the model of her class. At present prices for iron, etc., she could scarcely be built for $60,000, though her actual cost was $50,000.

THE GREAT GAS WELL AND CARBON FACTORY AT MURRAYSVILLE, PA.

About a year ago, in boring for oil at Murraysville, near Pittsburg, Pa., the boring tools tapped an extraordinary vein of natural gas. The flow was estimated at about 50,000 cubic feet per hour. Recent measurements show that instead of decreasing, the present flow is fully 10,000 feet per hour greater than the first estimate, while the pressure at the mouth of the well is 90 pounds per square inch. This enormous quantity of natural fuel has, up to this time, been mostly wasted, but will soon be utilized for the manufacture of carbon black, or "lamp" black, as it is more commonly called.

A Pittsburg firm, Messrs. Sherriff & Hazely, are at work upon a contract for the machinery and fittings of what will probably be the largest carbon black factory in the world. The appliances for collecting the soot from the Murraysville gas are the following: Near the well is erected a frame building, 300 by 175 feet, and into it the gas is led in four parallel lengths of 250 feet each, of 2 inch gas pipe. Along the sides of these are fitted short branches of ⅛ gas pipe, terminating in a slight upward curve and tipped with ordinary gas burners of 6 foot per hour capacity. Above these burners, at a distance of 10 inches, are placed a series of cast iron plates, contiguous and forming a smooth surface whereon the carbon black is deposited. A small car traveling on rails laid between burners and plates, and furnished with a scraping device, plies forward and back every ten minutes during the twenty-four hours. This carriage is propelled by steam

power, operating through wire rope and suitable gearing, drums, etc. The smoke or carbon black is scraped into pans hung upon the car, and these are dumped at each end of the route into receptacles, which are in turn emptied and deposited in the purifying and packing house. After simply removing cinders, etc., by passing through sieves, the soot is ready for the market. The daily product of this plant will be ½ pound carbon black per burner, *i. e.*, 2,000 pounds, there being 4,000 burners. Another plant of 4,000 burners is to be erected, the 8,000 burners to turn out two tons of carbon black daily. There will then still be 12,000 cubic feet of gas go to waste hourly, sufficient to light a good sized town. The owners of the Murraysville gas well refused $20,000 for it from the Edgar Thomson Steel Works, of Pittsburg, who wanted to connect the well with their works by a gas main, about 15 miles in length.

The phenomenon of an invisible gaseous substance issuing from the earth made visible, condensed into solid form, and packed up for market is strikingly illustrated in this establishment. The gas as it issues from the ground is unseen, but a given volume of it is found by chemical analysis to consist approximately (we do not mean to say absolutely and exactly) of twenty-four parts by weight of carbon and four parts of hydrogen; in other words, a quantity of the gas that weighs 28 pounds is made up of 24 pounds of carbon and 4 pounds of hydrogen. This hydrogen seems to have the power of imprisoning and concealing the carbon from human view. But carbon is carbon, whether in this gas or existing in the carbonic acid that gives pungency and effervescence to the soda water we drink, or in the lamp flame imparting its brilliancy, or in the sparkling diamond, the hardest of substances and the purest form of carbon.

The carbon that comes up in the gas well is rendered visible by separating the hydrogen from it, which is done by the heat of the flame. The hydrogen contained in the gas is burned up by uniting with the oxygen of the air, but only a portion of the carbon is burned; the unconsumed portion of the carbon, liberated by the burning of its hydrogen, rises up against the plates, where its sticks fast until scraped off as described.

NEW YORK ACADEMY OF SCIENCES.

The Chemical Section of the New York Academy of Sciences met Monday, Nov. 9, Prof. Newberry in the chair.

Mr. Kunz exhibited a specimen of fluorspar, one half of which was of an amethyst tint, and which had been fashioned into a rude ornament. It was found near Elizabethtown, Harden county, Ill., where fluorspar occurs in immense deposits.

He also exhibited a rock crystal pitcher of exquisite workmanship. It was made of an unusually large piece of crystal, and is without a flaw. Messrs. Tiffany & Co., to whom it belongs, value it at about six hundred dollars.

The paper announced for the evening was on the

ADULTERATION OF FOOD,

by Prof. A. R. Leeds, of the Stevens Institute of Technology, who had undertaken the investigation of a large number of articles of domestic consumption as a part of the work devolving upon him by his connection with the New Jersey Board of Health.

Prof. Leeds prefaced his remarks by the reassuring statement that many of the fears awakened in the public mind by the discussions in the newspapers concerning the deleterious or even poisonous character of various substances said to be used in the adulteration of many articles of food are entirely groundless, and that the most searching analyses in his own laboratory failed in nearly all cases to reveal their presence, although the articles tested were for the most part purchased at the meanest shops, whose custom consisted of the poorest class of the community. The adulterations found consisted mostly of substances harmless in themselves and used for the purpose of increasing the weight or bulk of the articles sold. Such adulteration must of course be branded as fraudulent; but while it is an offense against public morality, it is not one against public health. The following are some of the articles examined.

It has been objected to by some that bread is adulterated with potatoes, but this addition, so far from being injurious, actually improves the quality of the bread. A few samples of bread contained very small quantities of alum, said to be used for the purpose of making it whiter and lighter. Some contend that a very little alum is not injurious because it is rendered inert by the phosphate of lime contained in the flour, and also by the acids of the gastric juice. Not the slightest trace of copper was revealed in the bread examined by the most searching methods of analysis. Saleratus was found in nearly all cases to consist, as it should, of perfectly pure bicarbonate of soda; but cream of tartar was found to be adulterated in some cases as much as sixty per cent. with terra alba. Baking powders, which should consist of bicarbonate of soda and cream of tartar in suitable proportions, kept from combination by the admixture of a little starch powder, were found to vary greatly in the amount of their effective constituents. All the sugars examined were found to be perfectly free from all injurious substances, while the cheaper grades of sirups contained considerable glucose, a substance much inferior in sweetening power to cane sugar. No trace of strychnine, cocculus indicus, or other poisons popularly supposed to be used in the manufacture of liquors, beers, etc., were discovered. No sulphuric, nitric, or hydrochloric acids were found in vinegar. All the samples examined derived their activity from acetic acid, of which, however, they contained different proportions. In other words, some of them were more or less diluted with water. None of the samples of milk examined were found to contain any more serious adulterant than water. A diligent search was made to find brightly colored cucumbers whose tint would seem to indicate that copper had been used to make them more attractive; in none of them, however, was even the faintest trace of copper found to be present. Canned goods were found to be free from all deleterious substances. Spices procured from various sources differed greatly in strength, and all contained foreign substances increasing their bulk and diluting their pungency. Different samples of teas examined chemically and under the microscope revealed the fact that they were adulterated by leaves of other plants to a very great extent. Some of the cheapest kinds, selling (say) for 35 cents a pound, contained no tea leaves whatever. Candies were found to be much more free from injurious substances than the public has been led to believe. Many of them contained a large admixture of glucose, but the coloring matters used were comparatively harmless. In some of them aniline colors were used, which, although poisonous, cannot be fairly so-called in the very minute quantities necessary to color candy.

Prof. Leeds also examined green wall papers for arsenic, and exhibited several tubes containing arsenic extracted from them. These papers must be condemned as highly injurious, especially as the arsenic is but loosely applied to the surface and is easily diffused through the air, whence it finds its way into the lungs. One specimen of arsenic shown was extracted, curiously enough, from a little green Christmas tree candle.

He concluded his paper by remarking that three things were necessary to keep the practice of adulteration in check: a strong public sentiment kept aroused by the public press; the enactment of stringent laws; and the appointment of competent persons to execute them.

Mr. Kunz remarked that a firm in New York city made a fortune by selling cocoanut shells to the manufacturers of spices, who ground them up to increase the bulk of their products.

Capt. Blake stated that it was perfectly impossible to buy pure tea at 35 and 50 cents a pound, seeing that a good article costs $1 a pound at Fouchow. C. F. K.

The New York Academy of Sciences met Monday evening, November 17, President Newberry in the chair. A large number of minerals was exhibited, among which a rough diamond from Brazil and a diamond crystal from South Africa attracted much attention. They were shown by Mr. Kunz, expert in gems at Tiffany & Co.'s. The first paper of the evening was on some

RECENTLY DISCOVERED CAVES,

by Prof. Newberry. A great many caves having been discovered in this country within the last few years, it may not be wholly devoid of interest to those who have not made them the subject of special study, to describe the method in which they were formed. An excellent illustration is furnished by the triangular plateau of Central Kentucky, which, like all the formations abounding in caves, consists chiefly of limestone rock. This rock, by its numerous fissures and joints, as well as by its solubility in water charged with carbonic acid, is peculiarly liable to be attacked by the action of rain water, which always contains a small percentage of carbonic acid. The surface of this plateau is always dry, and no rivulet or brook is found upon it. The rain almost immediately finds its way to the underground channels which previous rains have hollowed out, and continues the work of excavation. At first the natural joints or seams of the rock are widened into fissures, and then, where some portions are more soluble than others, these fissures are further hollowed out into caves, some of them twenty and thirty and even more feet long, whose ceilings and floors are adorned with beautiful stalactites and stalagmites deposited from solution as the water containing carbonate of lime slowly filters in and evaporates. In this way immense tracts of country, where limestone is the principal formation, are literally honeycombed with subterranean caves. The Mammoth Cave itself is a member of such a system of caves. In many cases, especially in the region of the Upper Missouri, and between the Rocky Mountains and the Sierra Nevada, the same volcanic action that upheaved the limestone also brought up from below springs containing metallic substances in solution. These substances were then deposited in the fissures of the rock and also on the walls and floors of the caves. The most common are ores of iron, such as limonite, and of lead, such as galena. Many fortunes have been made and lost again by those who made it their business to explore these limestone regions for caves containing lead. The method followed is that of simply sinking wells at intervals and examining the excavated minerals. In this connection Dr. Newberry told an amusing story of an enterprising individual who had spent several fortunes acquired in this way. When at length his purse was nearly exhausted, he spent his time driving around the country to examine the wells dug by others in the hope that his superior experience would enable him to recognize signs of mineral deposits which had escaped the eyes of others. He succeeded in purchasing an unpromising looking well for a hundred dollars, and, upon exploring it, he found sufficient indications to warrant him in buying up considerable land around. When he had established his title, he descended his well alone to continue his search. To his great surprise, he struck a passageway leading into a cave that contained thousands of tons of lead ore. He jumped down into it, stuck his candle into the sand, and began to reflect how he could apply his new fortune to a better purpose than his former ones. His pleasant reverie was, however, brought to a sudden close. His last candle went out, and he was left in darkness so dense that he could not find the hole through which he had entered. After many fruitless attempts he finally thought of the following very sensible method. As he tried each spot along the walls of the cave by raising his pickax above his head and feeling his way with it, he marked the place with a stone. He finally regained the upper regions hungry and faint, after an imprisonment of forty-eight hours. Notwithstanding his good resolutions, the new fortune did not last much longer than the old ones.

The caves found between the Rocky Mountains and the Sierra Nevada, in the region of the lost mountains, so-called because short mountain chains rise there at intervals from a perfectly level surface, are distinguished by the fact that they contain the precious metals associated with iron and lead: gold with iron pyrites and silver with galena. The celebrated Emma mine and the Eureka are examples of this kind of deposit. The fluctuations in the value of mining stocks of this kind depend upon the beautiful uncertainty as to the continuity of the deposit. It may "pinch out"—that is, become so insignificant at any time that it will not pay to work any longer; and then again it is just as likely that new openings into rich deposits may be found.

The next paper was on a new proof of the

SUBSIDENCE OF OUR COAST,

by Prof. G. S. Martin. He exhibited specimens of peat that had been washed ashore at Long Island. They were similar to those found by Scudder on the Nantucket beach, and by Dall at Nahant. Their appearance indicated that they had been burrowed into to such an extent as to cause them to be broken by the action of the waves and detached from ancient peat bogs, whose edges crop out along the coast under the surface of the sea. These bogs, which belong to the period of glacial, or perhaps to that of terrace, elevation, thus furnish an additional evidence of the subsidence of portions of our coast extending through long periods of time.

C. F. K.

The American Institute of Architects.

The thirteenth annual convention of the American Institute of Architects began in this city, Nov. 19, nearly all the chapters being represented. In his annual address, President Walter spoke very hopefully of the influence exerted by the organization in raising public opinion to a higher level in all matters pertaining to architecture. Works of recent date exhibit, he said, a freshness in their architectural handling that seems to indicate the advent of a new era in the art of design. The manifest tendency of architects to break away from the trammels of conventional rules, and to make style subservient to the spirit of the age, indicates a progress in the development of independent thought hitherto unknown. Architecture, both in this country and in Europe, is obviously in a transition state. What may be the result remains to be seen; if, however, architects are careful to design their works on true æsthetic principles and in conformity with the science which underlies the art, it is not likely to be regretted that they show a disposition to do their own thinking. Classic forms and combinations are everywhere yielding to more ornate compositions bearing the names of fashions of building having no trace whatever of paternity, either ancient or modern. Particular stress was laid upon the claims of domestic architecture, particularly with reference to improvements in processes for warming and ventilating dwelling houses, the disposition of sewer gas, drainage, and other sanitary questions.

THE NATIONAL PUBLIC HEALTH ASSOCIATION.

The annual convention of the American Public Health Association took place at Nashville, Tennessee, Nov. 18. Over two hundred members were present at the first session, including nearly all the leading sanitarians of the country. The programme announced some weeks since in this paper contained many subjects of interest and importance to the whole country; and there is reason to expect large public benefits to flow from the united attention brought to bear upon the great questions of public sanitation treated in the numerous papers and discussed by the members.

THE description of Ward's steam generator, on page 333, of current volume, states that the generator furnishes steam to a single engine. Mr. Ward informs us that it supplies steam for two engines, 9¾ cylinders, 36 inch stroke, making 35 revolutions per minute.

A Ban on Inflammable Goods.

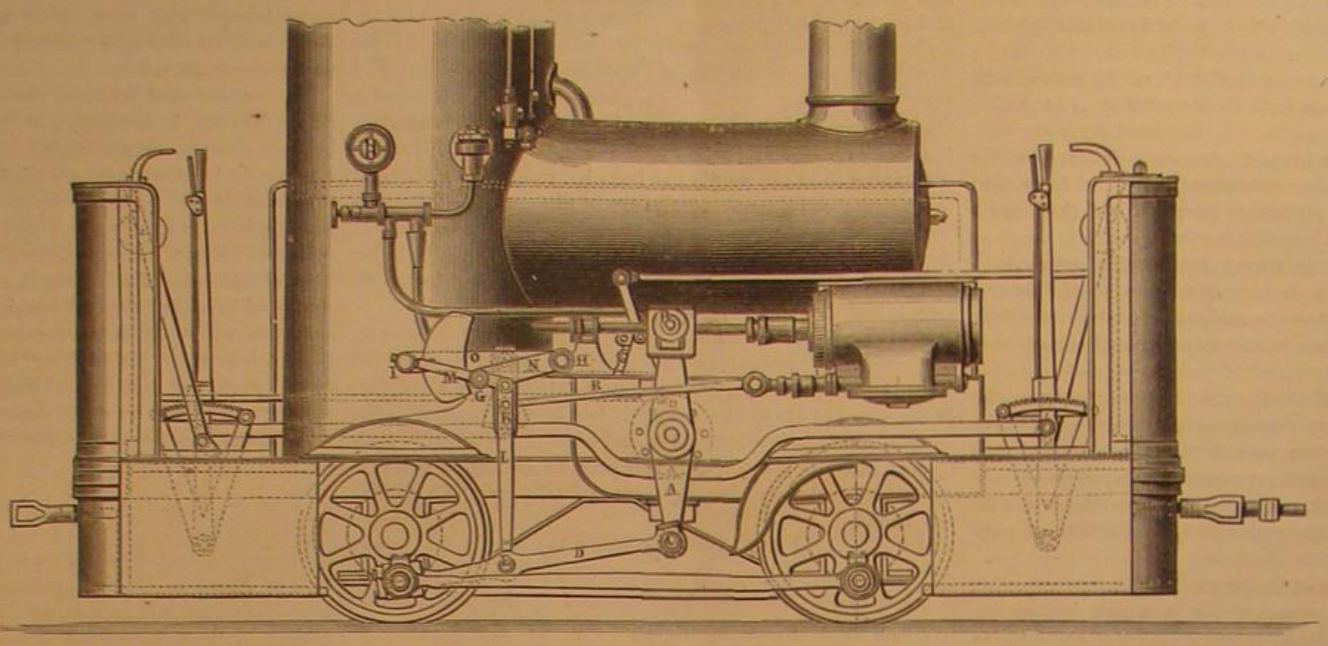
In consequence of recent disclosures the directors of the North German Lloyd's Steamship Company have decided to refuse transportation on their vessels to the class of heavy French silks which are so weighted with chemicals and oils as to cause danger of spontaneous combustion.

A HANDSOME TRIBUTE.—The Lords of the British Admiralty have given orders for the making of a handsome piece of furniture from the timbers of the old Arctic exploring ship Resolute for presentation to Mrs. Grinnell, the widow of the late Henry Grinnell, of New York, who fitted out at his own expense two expeditions for the search of Sir John Franklin.

NEW TRAMWAY MOTOR.

The accompanying engravings represent a very successful little motor used in propelling tramway cars. In the month of March, 1877, sixty-five locomotives of this style were in use in Strasbourg, Hamburg, Geneva, Paris, Milan, Rome, Madrid, and Turin. It is stated that trials made with this and other locomotives in Berlin, Cologne, Porte, etc., resulted in a victory for the Brown locomotive.

The movement of this machine is very quiet and regular, the mechanism is simple, and the locomotive can be attended to by a single person. The exhaust makes little noise, in fact is hardly perceptible. The gentleness of the action is due to the transmission of the motion by the lever, A, which gives a perfect equilibrium to the moving parts. There are controlling levers at both ends of the locomotive, so that in whatever direction the train moves the engineer can always sit in front. The fire box is furnished with an inclined grate, upon which the descent of the coal is very regular. A single charge of coal lasts about one hour.

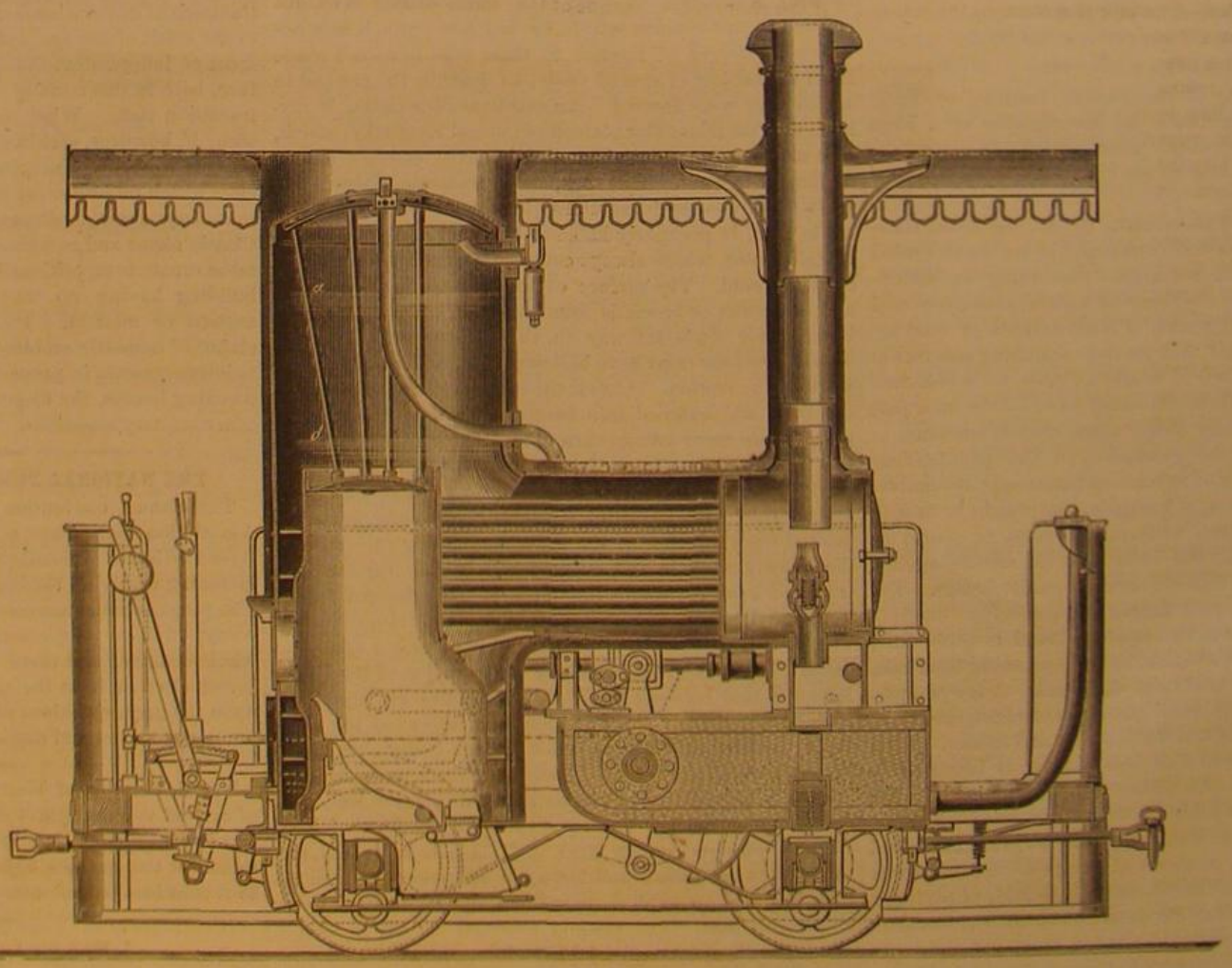


NEW TRAMWAY MOTOR.

The boiler is of the style generally used in small locomotives, but the vertical part is so large that the level of the water can vary about nineteen and a half inches, which corresponds to about seventy-five gallons. The boiler is filled at the station, and the engineer need not waste time during the trip to refill the boiler, and it is therefore possible for a single person to run the engine, as has been proved at Strasbourg. The distribution of the steam in the cylinders is obtained by means of peculiar mechanism which receives its motion directly from the crank. By this means the expansion can be regulated to any desired degree. With a boiler pressure of 150 lb., the steam may be cut off early in the stroke. In Strasbourg and Beziers, where the grade is from one to one and a quarter inches, these machines draw four cars with 200 to 250 passengers. In order to diminish the noise of the exhaust steam it is allowed to pass into a vessel situated between the cylinders and containing water. The pressure in this vessel is almost constant, which causes the steam to escape continuously and with noise. The chimney consists of two sheet iron cylinders, between which there is a packing of mineral wool, which prevents all vibration.

The steam passes from the vessel between the cylinders into a series of short tubes placed in the chimney. At every stroke of the piston a good draught is obtained, which superheats the smoke and gas, and makes it invisible at the top of the chimney.

If the normal atmospheric temperature is higher than 50°, this method will answer, but in winter a surface condenser, over which the steam passes after leaving the cylinder, is required. The axle boxes are constructed so that the smallest curves can be turned without difficulty.



TRAMWAY MOTOR—LONGITUDINAL SECTION.

A COAT of gum copal varnish applied to the soles of boots and shoes, and repeated as it dries until the pores are filled and the surface shines like polished mahogany, will make the sole waterproof, and it lasts three times longer.

Where did the Israelites Cross the Red Sea?

This query, some explorer has suggested, may be solved with our present appliances for fathoming depths. The *Christian at Work*, alluding to the subject, says that three or four theories prevail as to the spot the crossing was made.

The Arabs say several miles south of Suez, between the promontory of Atakah and Ayan Musa, where the Red Sea is about ten miles wide. This view is strengthened by the Bible reference to the walls of water on both sides of the army, but, as Dr. Schaff says, "it is impossible that six hundred thousand armed men, with women and children, and their herds of cattle, could have crossed so great a distance in one night without a prodigious accumulation of miracles." Another theory places the crossing at the head of the gulf, a little north of Suez. Here is a shoal channel, four miles long and less than half a mile wide, in which there are several islands and sand banks, bare at low water. The Israelites might easily have crossed here; indeed, so strong is the tide that a strong east wind—such as we are told Jehovah caused to "blow all the night"—would have made the walls of water of which the Bible speaks. This place is generally favored by modern biblical critics. The reader will recall the fact that it was here that Napoleon, deceived by the tidal wave, attempted to cross in 1799, and, in his own words, nearly became a second Pharaoh. As we have said, it is not likely that any of the rusty old chariots, nor so much as a broken axle or harness buckle, will ever be brought to light. Possibly some papyrus may be found with a private record of the wonderful event. But the search for this would be about as uncertain as the hunt after the precious stones that Aaron wore in his breastplate.

Proposed River between Manchester and Liverpool.

A meeting has been held in Manchester for the purpose of considering the expediency of the proposal for the construction of a tidal navigation for seagoing steamers between Manchester and Liverpool. At this meeting Mr. Hamilton Fulton, the engineer, explained the nature of the proposal, and stated that the length of the channel between Manchester and Liverpool would be about 36 miles. The minimum width of the navigation would be 200 feet, and the minimum depth at low water spring tides would be 10 feet, or about 2 feet more water than exists at low water over the bar at the mouth of the Mersey. A basin would be provided at the Manchester end of 81 acres with 16,000 lineal feet of well constructed wharves, and all requisites for shipping accommodation on a large scale. The estimated cost of the undertaking is £3,500,000. Mr. George Hicks, of Manchester, presented a statement as to the probable revenue, which, if realized, would give a large return upon the proposed outlay.

Owing to the inability of several members of Parliament and others to attend, the further consideration of the subject was adjourned.—*Warrington Guardian.*

Crushed by an Anaconda.

One of the most intrepid wild beast tamers in Europe, Karolyi, a Magyar of colossal stature and extraordinary physical strength, has recently fallen a victim to a dread contingency of his perilous profession. He was performing before a crowded audience in Madrid the other day one of his most sensational feats, which consisted in allowing a huge boa constrictor, over twenty feet in length, to enfold his body in its tremendous coils, when suddenly a piercing cry escaped him, which was greeted by the public with a round of applause, under the supposition that its utterance constituted a part of the performance. It proved, however, to be the outcome of a strong man's death agony. The gigantic snake had tightened its coils and crushed poor Karolyi's life out of him with one terrific squeeze. As his head fell back and his eyes became fixed in a glassy stare, the plaudits died away and were succeeded by the stillness of utter consternation. The snake and its lifeless victim swayed for a second or two of inexpressible horror and then toppled over on the boards of the stage; but the boa did not in the least relax his grip upon the corpse, which remained for more than an hour imprisoned in its hideous thraldom, nobody daring to approach the lithe monster, of whose powers such appalling proof had been given. At length it occurred to one of Karolyi's attendants to place a bowl of milk in a cage within sight of the mighty serpent, which slowly unwound itself from the dead body and glided into its den, irresistibly tempted thereto by its favorite dainty. A post mortem examination of the unfortunate athlete's remains discovered no fewer than eighty-seven fractures of his bones effected by the constriction of the serpent's coils.

HINTS TO THE YOUNG STEAM FITTER.

BY WILLIAM J. BALDWIN.

The low pressure gravity circulation is at present very much used in the steam heating of private houses, churches, and schools. Its principal merits, when well done, are: It is safe; it is noiseless; the temperature of the heating surface is low and uniform; all the water of condensation is returned into the boiler except a very small loss from the air valves; it is easy to keep the stuffing boxes of the heater valves tight; and it is no more trouble to manage than a hot water apparatus.

There are four systems of low pressure steam piping, whose principal features are:

1st. Main distributing pipes and distributing risers, with corresponding return mains and risers (see Fig. 1, at A).

2d. Main distributing pipes and distributing risers, with a corresponding return main and a separate return riser for every coil or heater, the return risers not to be connected to each other until they are below the water line (see Fig. 1, at B).

3d. Main distributing pipes and distributing risers, with corresponding return mains and no return risers, the distributing riser carrying the water of condensation back through a relief to the main return pipe on the floor of basement (see Fig. 1, at C).

4th. (The single pipe job always a small one.) A single pipe for every heater, run directly from the top of the boiler to the heater, rising all the time in the direction of the heater, and of size sufficiently large that the steam passing to the heater to supply the loss from condensation will not interfere with the condensed water returning along the bottom of the pipe.

NOMENCLATURE.

The same names always apply to the same part of the circulation, no matter what the system. The word circulation means the whole distribution of pipe in any one job.

The Main Steam or Distributing Pipe.—The nearly horizontal live steam main, generally near the cellar ceiling (a' a'' a''').

The Main Return Pipe.—The nearly horizontal pipe on the floor, or thereabouts, of the cellar, for carrying the condensed water back to the boiler, b' b'' b'''.

The Steam Riser.—The pipe that carries the steam from the main distributing pipe to the radiators (c' c'' c''').

The Return Riser.—The pipe that carries the condensed water from the radiators to the main return (d' d').

The Steam Riser Connection.—The pipe that joins the main distributing pipe and steam riser (e' e').

The Return Riser Connection.—The pipe that connects the return riser with the main return pipe on the floor, and which has one or more T's in it below the water line to receive the steam riser relief (f f).

The Steam Riser Relief.—The pipe that connects the bottom of the steam riser with a T in the bottom of the return riser connection or main return pipe below the water line, to carry the water that runs down the steam riser into the return riser connection or main return pipe (g g).

Main Relief Pipes.—Connections between the main steam and return pipes, to throw the water carried from the boiler, and what is condensed in the main steam pipe, into the return main, also as an equalizer of pressure in the system (h).

Radiator Connections.—The pipes which run from the risers to the radiators, both steam and return, usually no longer than is necessary to get spring enough for the expansion of the risers (i i i).

A Relay.—The jumping up of a main steam pipe, with a main relief at the lower corner. This is to admit of keeping the main steam pipe near the line of the risers and the ceiling, and above the water line when the main lines are long (j).

Pitch.—Is the inclination given to any pipe, and in the steam mains of a low pressure apparatus should be down and away from the boiler (except in system No. 4), and if possible toward the boiler in the main return. (When the water and steam run in the same direction through pipes one source of noise is prevented.)

Water Line.—The general level of the water in the boiler throughout the apparatus. In some cases, where the boilers are at a distance, or in a sub-cellar, and the fitter wishes to gain the advantages of having returns and reliefs coming together below water, he makes an artificial water line by raising the main return pipes higher than his connections before he drops to the boiler. It is also necessary to bring a relief from the main steam pipe to this raised part of the return to prevent siphoning into the boiler.

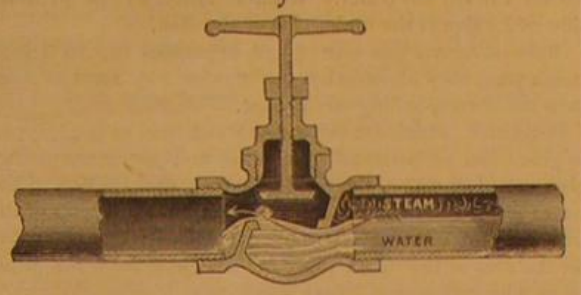
HOW A BUILDING IS PIPED.

The steam-fitter should commence his work in a new building early, and architects and parties paying for the work should see that the contract for steam heating is let when the mason and carpenter work is let.

The risers are the first work done in a new building that proceeds in the ordinary way. If the builder and steam-fitter have an understanding at the commencement of the work, the former can leave the proper recesses in the walls exactly where the steam-fitter wants them. This will save much work to the fitter, and prevent the mutilation of the walls and be no expense to the mason.

Fig.2.

Fig.3.



POSITION OF VALVE.

When the walls are up, the joists in their places, and the roof boards or roof on, the steam-fitter should then put up his risers.

If the building has not more than three floors to be heated it will do to rest the risers on a support at the bottom of the recess, but in higher buildings the risers should be suspended by the middle, so that the expansion may be divided. By allowing the riser to go both up and down from the middle the steam-fitter will be able to get along with shorter radiator connections, and will avoid the deep cutting of the floor joists.

The steam-fitter should avoid as much as possible taking two heaters from the same steam connection on a floor, and if it is unavoidable he should drop his returns down and bring them into the return riser some distance apart; or, better still, he should run them separately down below the water line (system No. 2), as it will prevent one heater from taking the air from the others.

If the risers are on the side of the room so that their outlets look between the joists, it is best to keep the T's about half way between the laths and the flooring, as this admits of nippling up, and leaves room for crossing the pipes, if required, below the floor. But if the outlets come at the side of the joists care must be taken that the T's come in the exact place. In a building with the risers resting on the bottom and all the expansion upward, the top outlet must be the lowest from the top of the joist, but only low enough to come within ¾ of an inch of the floor when expanded to their utmost; so also with the rest of the T's, according to their distance from the bottom of the riser.

With low pressure steam, the steam risers should be large

Fig.1

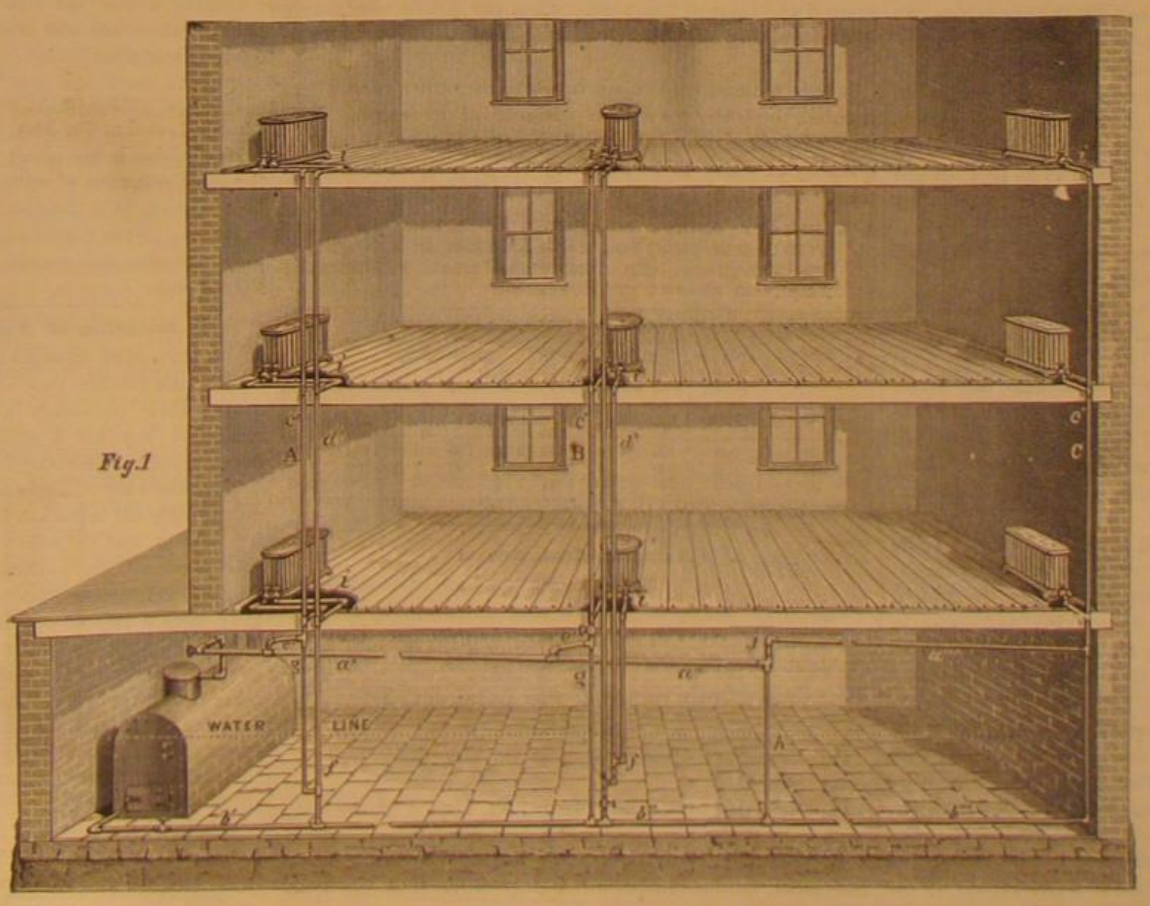


FIG. 1.—**SYSTEMS OF PIPING.**

The general practice with steam-heaters is to reduce one size of pipe for each floor. This rule is not arbitrary, but as architects' specifications usually call for it there are no objections, provided the pipe is large enough.

In system No. 1 the return riser is generally one size smaller than the steam riser, but it should never be smaller than a ¾ of an inch pipe.

In system No. 2, where many return risers are brought down in the same place, a 1 inch pipe for large heaters and a ¾ pipe for small ones are usual.

When the risers are all in the outlets should be plugged up with pieces of pipe, a foot or so in length, instead of the ordinary plug, as the latter is often difficult to get out when the plastering is done.

The risers should then be tested with cold water to from 100 to 200 pounds per square inch; this will prove if there are any cracked fittings or split pipe, and will save much time and annoyance when steam is gotten up.

The best way to cover a riser recess is with a board. Have grounds put on before the plastering is done, and screw a panel on afterward. Some architects require the recess to be plastered over, using slate or coarse wire cloth to hold the plaster. The latter makes the best work, as the heat from the riser will not crack it.

When automatic air valves are to be used on the steam heaters, a ⅜ inch pipe should be run in the riser recess, with an outlet at each floor to receive the air valve connection. The lower end of this air and vapor pipe should be taken to the nearest sewer outside of the sewer traps.

At this stage of the work, and before the floors are laid, the radiator connections should be run and firmly fastened in their places, making due allowance for the thickness of the furring on the walls, the plastering, and the baseboard. The radiator connections are usually run 1 inch or 1¼ inch for the steam connection, with a corresponding ¾ or 1 inch pipe for the return, according to the size of the heater; one and a quarter inch steam being enough for a radiator of 150 square feet of heating surface at low pressure, with a main of sufficient size.

When the radiator valves are threaded right-handed the elbows on the ends of the connections may be left-handed, to admit of connecting by a right and left hand nipple below the valve and between the valve and elbow, or *vice versa*.

When both valves are at the same end of the radiator, it is better to have the right and left nipples between the valves and the radiator. With this arrangement both valves of the radiator can be connected simultaneously, and the movement of the radiator will be in the direction of the valves. It also admits of the disconnection of a heater, after simply closing the radiator valves.

When the radiators are to be connected by any of the foregoing plans the connections can be firmly fastened, but not confined at their ends, that they may come in their exact places through the floors. The free ends of the connections should be closed with pieces of pipe long enough to come above the floors when laid. The air pipe should also be run at the same time and brought through the floor in close proximity to the position the air valve will occupy on the heater.

At this stage of the work the steam-heater usually waits until the floors are laid, plastering done, partitions set, and the basement graded.

Steam Mains.—Nearly all the success of the apparatus depends on its steam mains, their sizes, and how they are run.

A job has never yet been spoiled by having its steam mains large; still there should be a limit to their size, to prevent unnecessary expense and to keep the condensation and radiation of the distributing pipes at a minimum consistent with the actual requirements of the heating surfaces.

The size of steam mains depends on the pressure of steam to be used, the distance it is to be carried, the temperature of the exposure of the heating surfaces, and their extent. But as it is not my intention here to speak of steam used expansively, I shall endeavor to give sizes only for direct-return or gravity circulation apparatus.

Gravity circulation apparatus are of two kinds, low and high pressure. The low pressure apparatus depends on the difference of level of water in the return risers and the boiler for a circulation, irrespective of the steam pressure at any part of the distributing pipes; but the maximum pressure of steam to be carried must never exceed the equivalent of a difference in level of water between the water line of the boiler and the lowest part of the distributing main.

There is another condition under which this system will

work, and that is an increase of pressure sufficient to nearly establish a pressure throughout the apparatus, the difference in pressure at any part of the apparatus not to exceed the equivalent of a head of water between the water line in boiler and the lower part of the steam main. It is then a high pressure gravity circulation.

A well arranged gravity circulation should be made to work at any pressure, for with its heating surface properly proportioned it can be made to meet the exigencies of fall, winter, or spring weather by simply carrying a pressure suitable to the occasion.

To have the water of condensation return directly into the boiler under all conditions and pressures, the main pipes must be large enough to maintain the pressure of the boiler to within 1 or 1½ pounds in every part of the apparatus, and the water line of the boiler should be not less that 4 feet from the bottom of the horizontal distributing mains, at their lowest part, and that only in short mains, such as the generality of city business buildings and blocks. In large public buildings and others that have their boilers in outhouses, the difference between the boiler line and the mains should be all it is possible to get.

A main should not decrease in size according to the area of its branches, but very much slower, and should be rated by the heating surface and the distance it is to be carried. Neither should the main at the boiler be equal to the aggregate size of all its branches—an expression very much in vogue in specifications for steam heating.

Mains which have given the best results leave the boiler of sufficient size (calculated from practical results), and are reduced very slowly, if at all, until very near the end.

The area of the cross section of a 1 inch steam pipe is taken as unity for the sake of easy calculation in the rating of steam pipes, and the area of a 1 inch pipe in the main, at the boiler, to each 100 square feet of heating surface, mains included, is deduced from the size of the mains and heating surfaces of some of the best heated buildings in the United States, and has been the writer's rule for some years.

When the main steam pipe leaves the boiler it should, if possible, be carried high up at once, and have the stop valve at the highest part in the pipe, so that condensed water cannot lodge at either side of it when shut. This will prevent cracking at this part of the pipes when the valve is opened. If this arrangement cannot be carried out, and the valve has to be nippled on the dome of the boiler, or if there are several boilers and they have to be made interchangeable with regard to their use, there should be a relief of large size in the main, just outside the valves.

It is well to mention here that a relief which leaves the steam pipe must be brought into the return pipe in a position corresponding exactly to where it leaves the main; that is, when it comes from the outside of the main stop valve it should be taken to the outside of the main return valve. Otherwise, if an attempt is made to shut off, and both valves are closed, the water will back up and fill the apparatus. So also with all branch risers or connections; if there is a valve in the steam part, there must also be one in the return, and reliefs must leave the steam pipe and enter the return on corresponding sides of the respective valves.

From the highest point the main steam pipe should drop slowly as it recedes from the boiler (1 inch to 10 feet being a good pitch), that the course of the steam and the water may be in the same direction.

A main steam pipe should not run very close to the wall up which the risers go. There should be room enough for a riser connection 2 or 3 feet, and when the mains are long and the expansion much the distance should be increased.

The T's in the main, for the riser connections, are better turned up than sidewise, as by nippling an elbow to them you can get any desired angle, and should the measurement for the main be a little out it will make no difference. This arrangement also makes a good expansion joint if the mains have much travel.

Where the pipe reduces in size it is well to put in a relief in the lower side of the reducing fitting, as the water that is pocketed there by the large pipe pitching in the direction of the smaller one may be the cause of cracking and noise in the pipe. Some steam-heaters use an eccentric fitting in reducing, which brings the bottom of the pipe on the same line and makes nice work.

When it is necessary to have stop valves to the risers the steam-fitter often places them in the riser connections, with a valve also in the riser relief. This arrangement requires three valves, and also stops the local circulation and equalization of pressure.

It is better to use only two valves, one to the steam and one to the return riser, and place them a few inches up the riser, above the riser connection, which brings them also above the steam riser relief, saving a valve and lessening the chances for noise in the pipes.

In system No. 2, where the returns are carried down separately and collected together below the water line, the return valve should be below all such connections, and the steam riser relief should have a separate connection with the main return and have no valve. Straightway valves are best for risers.

The extreme end of a steam main should be connected by a relief with the main return, being in fact a continuation of the main down and into the return.

Stop valves in main steam pipes are either globe, angle, or straightway. When a globe valve is used it should be turned with its stem nearly horizontal, as shown in Fig. 2. The reason for this is obvious, when we consider that the water of condensation in any pipe runs along the bottom of it. When a globe valve is turned up, as in Fig. 3, the water in the pipe has to half fill it before it flows over the valve seat to pass along in the pipe. Not so when the valve is on its side for then the side of the opening of the valve seat is as low as the bottom of the pipe.

Neither should the stem of any valve be quite down to the horizontal position when it can be avoided. It should be raised enough (10 degrees) to prevent water from collecting in the threads of the nut and stem, and being forced out, by the pressure of the steam, through the stuffing box, making a constant dropping of water, which is almost impossible to hold with ordinary packing. Not so with dry steam; it can be held.

Globe or angle valves should be so turned in a heating apparatus that by simply closing the valve to be packed and its corresponding valve in the return, or *vice versa*, and waiting for the steam to cool down, the stuffing box or gland can be removed without the escape of steam. To do this it is necessary to have the pressure side of every pair of valves turned toward the boiler. What is meant by the pressure side of a valve is the under side of the disk.

Main Return Pipes.—In small apparatus (up to 3 inch steam pipe) they are usually run one or two sizes smaller than the corresponding steam pipe.

In returns, which are below the water line, or are trapped to give them an artificial water line and are consequently always full of water, there are no currents but the flow of the water toward the boiler. This style of return admits of the smallest piping, but good practice has placed it at one quarter the area of the steam pipe, for all conditions, for apparatus with larger than 3 inch steam pipe.

In dry returns—*i. e.*, which have no water line—there are local currents, often going in contrary directions, the water gravitating toward the boiler, the steam flowing to the heaters, and the air, the greatest source of annoyance to the steam-heater, going every place and any place except out of the air valve. This style of return is not much used, but in cases where there is no basement it cannot always be avoided.

One half the area of the steam pipe has been found in practice to give good results in dry return pipes.

Check valves are generally used in return pipes where they enter the boiler. Some steam-heaters leave them out on account of the back pressure they cause to the return water, but the practice is very much to be condemned when two or more boilers are connected, as an inequality in draught or the cleaning of a fire will make a small difference of pressure between boilers, causing the water to run from one boiler to another through the return pipes.

Check valves of large area in the opening, with a small bearing on the seat, can be made that will not give more than a quarter of a pound back pressure. If the valve is not ground and cleaned frequently when the job is new, there will be nothing but the actual weight of the disk to overcome.

It is sometimes convenient to reduce a return pipe where it enters the boiler for a short distance of its length. This may be done to a limited extent, bearing in mind the actual quantity of water to be admitted to the boiler in a given time.

A TABLE OF LINEAR EXPANSION OF STEAM PIPES (TO WITHIN 0·01 INCH) FOR EACH 100 FEET IN LENGTH, AT TEMPERATURES AND PRESSURES MOST FREQUENTLY REQUIRED BY THE STEAM-FITTER.

Temperature of weather when pipe is fitted.	Length of pipe when fitted.	Length of pipe when heated to							
		215° or 1 lb. steam.		269° or 25 lb. steam.		301° or 50 lb. steam		342° or 100 lb. steam	
Degrees Fah.	Feet.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
0	100	100	1·80	100	2·26	100	2.53	100	2·88
32°	100	100	1·54	100	1·98	100	2·26	100	2·61
64°	100	100	1·20	100	1·73	100	2·	100	2·35

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they will enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR DECEMBER, 1879.

Mercury.

On December 1 Mercury rises at 8h. 37m. A.M., and sets at 5h. 26m. P.M.

On December 31 Mercury rises at 5h. 47m. A.M., and sets at 3h. 6m. P.M.

Mercury should be looked for during the last week of December, before sunrise, a few degrees north of the point of sunrise.

Venus.

Although less brilliant than in November, Venus will be very beautiful in the early morning through December.

On the 1st Venus rises at 3h. 9m. A.M., and on the 31st at 3h. 54m. A.M.

It will be at its greatest western elongation on the 3d. On the 10th of December Venus and the narrow crescent of the waning moon will rise nearly at the same time, Venus being north of the moon. A telescope of three inches aperture will show that the disk of Venus, like that of the moon, is seen only partially enlightened by the sun. It will be half illuminated in December.

Mars.

Mars was in its best position in November, but it will be more likely to be observed in December, as it comes to the meridian during the evening and precedes the beautiful group of the Pleiades.

On December 1 Mars rises at 3h. P.M., and sets at 5h. 8m. the next morning.

On December 31 Mars rises at 59m. after noon, and sets at 3h. 13m. the next morning.

A small telescope will show peculiar markings upon Mars; it is, however, less interesting then Jupiter and Saturn, as its newly discovered moons can be seen only by means of the largest telescopes.

On the evening of December 23 the moon will be seen to draw near to Mars, and after midnight to pass east of the planet, Mars being about 3° lower than the moon in altitude.

Jupiter.

Jupiter is still the great light among the planets, yet is setting earlier, and is perceptibly more remote from us.

On December 1 Jupiter rises at 26m. after noon, and sets at 11h. 7m. P.M.

On December 31 Jupiter rises at 10h. 38m. A.M., and sets at 9h. 31m. P.M.

If we take the hours from 8 to 10 P.M. for observing Jupiter we shall not see the first satellite during a part of that period on the 5th, 14th, and 21st, because it is behind the planet; it is unseen because in transit across the planet, December 6 and December 13; on the 30th it reappears from the shadow, having been eclipsed.

The second satellite, the smallest, is not to be found at some part of the period from 8 P.M. to 10 P.M., because behind the planet December 1, and in transit across the planet December 10 and 17.

The third satellite reappears from transit December 9, and disappears December 27, by passing into the shadow of Jupiter.

The fourth satellite will not be seen on the evening of December 31, because in Jupiter's shadow. The moon will pass east of Jupiter on the evening of December 18.

Saturn.

With a powerful glass Saturn is even more interesting than Jupiter; with an ordinary glass its ring and the two larger satellites can be seen.

On December 1 Saturn rises at 1h. 51m. P.M., and sets at about the same hour the next morning.

On December 31 Saturn rises at 11h. 53m. A.M., and sets 3m. after midnight.

Between December 18 and December 24 the moon passes Jupiter, Saturn, and Mars by its motion in orbit; it passes Saturn before noon of the 21st. On the evening of the 20th Saturn will be east of the moon; on the evening of the 21st Saturn will be west of the moon.

Uranus.

On December 1 Uranus rises at 11h. 27m. P.M., and on the 31st at 9h. 29m. P.M.

Uranus is near the star Lambda Leonis, 2¼° nearer the horizon when that star culminates, or between 4 and 5 A.M. during December.

Neptune.

Neptune comes to the meridian at 9h. 50m. P.M. of December 1, and at 7h. 50m. December 31.

Its position is not much different from that of Mars. On the 1st Neptune is 4° south of Mars, and passes the meridian 14m. earlier. On the 31st Neptune is 15m. earlier than Mars in coming to the meridian, and 5° south of Mars. Only a powerful glass will enable the observer to distinguish it from a fixed star.

Relation of Masters and Apprentices.

We have often thought that if masters properly comprehended the relation they sustain to their apprentices and employes, their pecuniary interest would not only be greatly enhanced, but that a positive good would be rendered to every branch of industry in which they are engaged.

The first duty of a master should be to present in himself an example for imitation in the elements of industry, morality, system, and the other attributes which constitute a superior mechanic or workman. They should, moreover, observe and study the dispositions and minds of their apprentices, with a view of conciliating their regard and confidence, and through this means to establish a free and familiar intercourse, and render the task of instruction and development more simple and easy. As the apprentice advances in knowledge and skill, suitable evidences of appreciation and encouragement should be given them. This will stimulate their ambition and exertion, and create among them a worthy spirit of emulation.

Where the character of an apprentice is such as to require a tight rein upon his actions, and the deprivation of privileges, and other suitable punishments for idleness and misconduct, care should be observed that these curbs and punishments do not descend into such acts of tyranny as will destroy the spirit and ambition of the youth, and render him obstinate, unruly, and beyond all future influences of excellence and good. Besides a thorough instruction in his trade or profession, and a sound and healthy education to otherwise render him fit for his social position in life, it should be the aim of a master to instill into his pupil all the scientific and other knowledge possible, even should such knowledge have no direct bearing upon the business or trade in which he is engaged. Such acts of interest, kindness, and confidence as these, and others of a corresponding character, cannot fail to produce the most marked beneficial results upon the interests of the master, and the happiness and future of the grateful apprentice.

AMERICAN INDUSTRIES.—No. 25.

THE MANUFACTURE OF SPOOL COTTON.

The manufacture of spool cotton requires machinery and processes so elaborate and so expensive, that the industry cannot be profitably conducted except on a very large scale. For this reason the making of the spool cotton used in this country is mainly confined to a few large factories, and we are informed that there is but a single company in America that makes all numbers of six-cord sewing cotton from the raw material. This is the Willimantic Linen Company, whose works we illustrate.

The company began business in the manufacture of linen; being deprived of flax by the breaking out of the Crimean war, they turned their attention exclusively to cotton thread, but the original style of the firm was retained.

The business offices of this company are located at Hartford, Conn.; the works are at Willimantic, on the river of the same name, about 125 miles from New York and 90 miles from Boston, on the New York and Boston Air Line Railroad. Two other railroads—the Hartford and Providence and the New London Northern—pass through the place, and hundreds of their passengers every day catch sight of the great, gray, six story mills of the thread company, built up of granite quarried out of the very ground on which they stand; and see, too, the rows of neat and comfortable tenements ranged along the streets. There are four large mills, picturesquely set upon the east bank of the river, and stretching, with their surrounding grounds, over a space of three quarters of a mile. The buildings and grounds are noticeably clean and orderly in appearance. By a series of dams, aided by a sharp natural fall, a force of fifteen hundred horse power is secured from the river for the factories. In these mills, as we learn from the elaborate description of them in *Scribner's Monthly*, to which we owe much of the information here given, more than a thousand workpeople—women and men, and girls and boys—are kept constantly busy at the various labors that combine to make thread.

The first operation in the preparation of the raw material for spinning is to run it through a machine called a "picker," which cleans about a thousand pounds a day.

The picker picks or beats out the dirt and seeds, and the cleaned cotton rolls out of the machine in laps, which are carried to the carding room, shown in one of the lower views in the engraving on the first page. The carding machine arranges the cleaned fibers parallel to each other, and delivers the cotton in a thin, narrow ribbon. After this operation the strand is run between sets of rollers, one set revolving faster than the other. This is called "drawing," and it is one of the most important parts of thread making. If one set of rollers, for instance, turns ten times as fast as the other, the strand that passes out between them is, of course, ten times lengthened and ten times as fine as the original. This is a "draught of ten," as it is called. The drawing may be in any ratio, and any number of strands may be run together into one at the same time that that is drawn. Five strands, for example, drawn with a draught of ten, would make a new strand half the size and ten times as long. This process of uniting strands is called doubling, and the doubling, running together, drawing down, and reuniting and redrawing are carefully watched, so that the size of the strand and the amount of work on it may be at any time known. The operation is repeated again and again; but all this doubling is not done without interruption. After the first few drawings, the long white ribbons of cotton which, in this condition, are called "slivers," are passed through another machine, which combs them again to remove all foreign substances; it also takes out all of the short fibers, leaving only the longer fibers to be worked into thread. The short fibers which are removed are sold for other manufactures. After combing, the sliver is doubled and again reduced in size, and then twisted for the first time in the roving frames and wound upon large spools, and it is afterward drawn and twisted in two separate machines before it is carried to the spinning mules.

The room in which the spinning is done is represented in the larger view in the engraving. In each of these machines there are several hundred spindles, which revolve very slowly as they are carried forward by the carriage in winding the thread on the spindle, but revolve with great speed as the carriage draws back in the operation of spinning. The spinning mule is entirely automatic in its action. The marvel of it all is the mathematical precision with which it begins, stops, and reverses, and the care with which it suitably varies its work each time to the needs of its case. The mule is all the while attended by a barefooted and lightly-dressed man or boy, whose business it is to unite such strands as accidentally part. On these mules the yarn is made of any size that is required. It is at Willimantic spun down to a fineness that rivals even the spider's web.

From the spinning mules the cops go to the cop winders, where two strands are wound together on a single spool. These two strands are twisted in a machine in which the bobbins revolve at a speed of about 5,000 revolutions per minute, and the thread is wound on the bobbins by a simple differential arrangement, which accommodates itself to the increasing diameter of the bobbin. Three of these double strands are twisted together, forming the well-known six cord spool cotton.

The spools from the twisting machines are conveyed to reeling machines, which form hanks suitable for bleaching, dyeing, etc.

During every step in the progress of the cotton, from the raw state to the finished thread, it is repeatedly examined by experts, and if at any stage it is not in all respects up to the standard it is rejected and never finished. Delicate instruments, which are used in testing the thread, are to be seen in all departments of this immense establishment. It is only by continually and closely watching the various steps in the manufacture of thread, that a uniformity in quality is secured.

It is established by all spinners that 7,000 grains shall be a pound in cotton, and that yarn of which 840 yards weigh this pound, shall be number "1." Every now and then, therefore, all through the mill, a very accurately gauged reel, or some similar instrument, is used to measure off an even fraction of 840 yards. The measurer may be careless in taking off his sample, but that makes no matter. At exactly the right point the reel breaks the strand and calls attention to the fact by ringing its signal bell. Then this sample, say 120 yards or one seventh of "a hank," is weighed on scales also gauged to show the most delicate variations. If the yarn or roving is number one, and weighs one-seventh of 7,000 grains, it is exactly correct; if 120 yards of No. "30," for instance, were being sampled, it should weigh one-thirtieth of one seventh of 7,000 grains. Every time a variation appears, the cotton is made to thicken up or thin out as is needed. This testing is done repeatedly, and the results are recorded in books kept for the purpose, so that the course of any of the cotton on its three weeks' cruise of three thousand miles through the factory, can always be traced and faults found and corrected at once. Nothing more impresses one with the wonderful accuracy of the process than to watch one of these testings, note the exact measurement of the sample, and rigidly careful weighing, and see the gravity with which the overseer marks down the pettiest variations to the 28,000th of a pound! It all tells upon the thread, and making it correct through all its processes guarantees it correct, of course, when finished.

After the thread is made the work on it is by no means finished. To prepare it for market it must be inspected, washed, bleached, dried, perhaps dyed, spooled, and boxed, and the spools and boxes are also made in the factory.

After the operations already described the hanks of thread are placed upon reels and transferred to large spools in the department represented in one of the upper views. The thread is then conveyed to the winding machines which take the spools, and, holding them between centers, revolve them, start the thread, wind it back and forth with the utmost precision, making allowance for the beveled ends, stop when the required 200 yards are wound, nick the spool, put in the thread, cut it off, and release the spool, all without attention. All that is required of the attendant is to see that thread is supplied, and to keep the hoppers full of spools.

One of the most interesting machines in this establishment is the machine for ticketing the spools. One girl supplies it with sheets of printed labels, and another feeds it with spools; it does the rest automatically. Provided with the labels, it cuts out, pastes, and fastens the proper mark for each end of the spool, and prepares a hundred spools a minute. The machine does the work of many girls, and it never tires.

The winding machine, the ticketing machine, and the automatic spool-making machine—inventions belonging to the Willimantic Company—are so essential to the thread business that the privilege of using them is rented by other manufacturers.

Everybody knows the sizes of thread. Every seamstress knows whether she wants No. 30 or 60 or 120, and knows, when she hears the number, about what is the size of the strand alluded to; but how the numbers happen to be what they are, and just what they mean, not one person in a thousand knows. It is a simple matter to explain. The standard of measurement is the same already recited. When 840 yards of yarn weigh 7,000 grains (a cotton pound), the yarn is No. 1; if 1,680 yards weigh a pound it will be No. 2 yarn. For No. 50 yarn it would take 50x840 yards to weigh a pound. This is the whole of the yarn measurement. Thread measurement rests on it. The early thread was three-cord, and the thread took its number from the number of the yarn it was made of. No. 60 yarn made No. 60 thread, though in point of fact the actual caliber of No. 60 thread would equal No. 20 yarn, being three 60 strands. When the sewing machine came into market as the great consumer, unreasoning in its work and inexorable in its demands for mechanical accuracy, six-cord cotton had to be made, as a smoother, rounder product. As thread numbers were already established, they were not altered for the new article, and No. 60 six-cord and No. 60 three-cord are identical in size as well as number. To effect this, the six-cord has to be made of a yarn twice as fine as the three-cord demands. The No. 60 six-cord would be six strands of No. 120 yarn. To summarize: yarn gets its number from the arbitrary formula that 840 yards weigh 7,000 grains. Three-cord spool cotton is the same number as the yarn it is made of. Six-cord spool cotton is made of yarn that is double its number.

As simple a thing as thread seems to be, the Willimantic Company makes 1,200 different kinds, and it takes 10,000 dozen spools to hold each day's product.

THE St. Gothard tunnel makes steady progress, no less than 3,000 workmen being engaged upon it. Nearly 10 tons of dynamite are used per month.

MISCELLANEOUS INVENTIONS.

Mr. A. Edward Barthel, of Detroit, Mich., has invented a hammerless self-cocking and rebounding firearm, the improvements being applicable to shotguns, rifles, or revolvers, either single-loaders or magazine arms.

Mr. Zebina M. Hibbard, of Brooklyn, N. Y., has patented a trace fastener provided with a screw stem that works in the threads of the ferrule, and is provided with a shoulder that fits within a rabbet of the ferrule.

Mr. Simeon Garratt, of Columbus, O., has patented a self-acting car coupling, which will couple high or low, which, when running, will only come apart by the use of the lever, but which will immediately separate should the cars run off the track.

An improved adjustable harness pad has been patented by Jacob Johnson, of Ashland, Neb. The object of this invention is to provide a harness pad which may be adjusted to the back of a horse of any shape or size.

An improved bale tie, patented by Mr. William H. Roane, of Pine Bluff, Ark., consists of a rectangular plate, having opposite edges bent over toward the outside, forming flanges or lips, through one of which is made a transverse rectangular slot in line with the outside of the plate, while the other is provided with a similar slot, and with an opening through from the edge of the lip or flange.

An improved spark arrester, patented by Messrs. Silas Byram, of Middletown, Ind., and William R. Hansford, of Hicksville, O., consists of two pipes set one within the other, with an annular space between them, the inner pipe being constructed in vertical sections, with lower edges inclined or drawn inward that are held apart by lugs or straps extending from one to the other, while fixed in the longitudinal axis of each section is a conical deflector, and encircling each section is an annular flange whose diameter is the same as the internal diameter of the outer pipe.

An improvement in candlesticks, patented by Mr. Andrew J. Smith, of Ukiah City, Cal., consists in providing a slitted match box rising up in the candle holder from the bottom of base.

Mr. John Henry Hettinger, of Bridgeton, N. J., has invented an improved can cover, which is simple, readily adjustable, and efficient, and may be used for cans and jars, paint cases, etc. It may also be applied to barrels, boxes, or cases of wood, as well as of metal, by only changing the material of which it is constructed.

An improvement in electric speaking telephones has been patented by Mr. Frank P. Mills, of Ishpeming, Mich. The object of this invention is to increase the sensitiveness of speaking telephones and the resulting effects by a new arrangement of the permanent magnet and the armatures thereof; and it consists, essentially, of a circular or cylindrical magnet surrounding the helix, the poles of which are brought close together, but insulated from each other by a peculiar arrangement and construction of armatures.

Mr. Oscar Kleinberger, of New York City, has patented a suspender having its ends formed of braid or cords which cross and overlap each other two or more times, and are fastened together at their junctions by threads or cords, thus forming a series of button holes or loops of like size.

Mr. Charles P. Blatt, of Elizabeth, N. J., has patented a simple and effective device for keeping beer and other liquids when "on tap" cold and supplied with common air or carbonic acid. It consists of a box or cabinet containing an air-tight chamber, an ice chamber, and a place for the barrel or other vessel containing the liquid.

Messrs. Hartwell A. Crosby and George F. Thompson, Jr. (administrator of Michael W. Thompson, deceased), of St. John, N. B., have patented an improved sash stop and lock. The object of this invention is to provide a more simple and durable sash stop and lock than those now in use. To close a window provided with this device, one has only to reach up and pull down on the thumb piece. If the window is partly open and it is desirable to raise it higher, it is only necessary to push it up, and the pawl will hold it at any point.

An improvement in riding plows, patented by Mr. Alfred Belchambers, of Ripley, Ohio, consists in a riding attachment composed of a frame mounted on wheels and drawn behind the mouldboard.

Commercial Enterprise.

Our English contemporaries seem to be awakening from their lethargy and to realize the cause for the depression in trade among their manufacturers.

Acute observers of the "spirit of the age," says one of the foremost trade journals of England, must have noticed the inborn love of conservatism, and the desire to follow in the footsteps of our fathers or predecessors that distinguishes us from our Continental neighbors and our American cousins. Progression in this country is usually the result of competition, or the force of circumstances, frequently impelling our ironmasters and our colliery owners to move with the times, and the steady-going British manufacturer to remodel his plant, improve his patterns, print his catalogues, and advertise his productions.

There can be no question that in many departments of trade the English name was at one time pre-eminently conspicuous, and our foreign rivals had to be content to follow the lead we were setting them. But, in too many cases now, the position is reversed, and "Jack is as good as his master."

It is unfortunate that such should be so, but a great deal of the present depression in trade is to be attributed to the

apathy of British traders. After being over-credulous for years they are now becoming over-cautious, and improvements or investments which show a good chance of being remunerative are either neglected altogether or postponed to an indefinite period.

The Wagon Hardware Trade.

Pittsburg seems to be a "head center" for the trade in wagon hardware. A recent article in these columns gave our readers an idea of the extent of the wagon and carriage building trade in the United States. A Pittsburg firm, Messrs. Lewis, Oliver & Phillips, employ about 700 men upon wrought iron wagon fittings. They control nearly 100 patents, covering the devices used and the processes for turning out the different parts by machinery. The firm make the necessary fittings for 90,000 wagons per annum, supplying the following wagon-making concerns: Studebaker, of South Bend, Ind.; Milburn, of Toledo, O.; Schuettler, of Chicago; Baine, of Kenosha, Wis.; Austin, Tomlinson & Webster Co., of Jackson, Mich., Moline Wagon Co., Moline, Ill., Kansas Manufacturing Co., of Leavenworth, Kansas, and others.

ARTIFICIAL HAYMAKING.

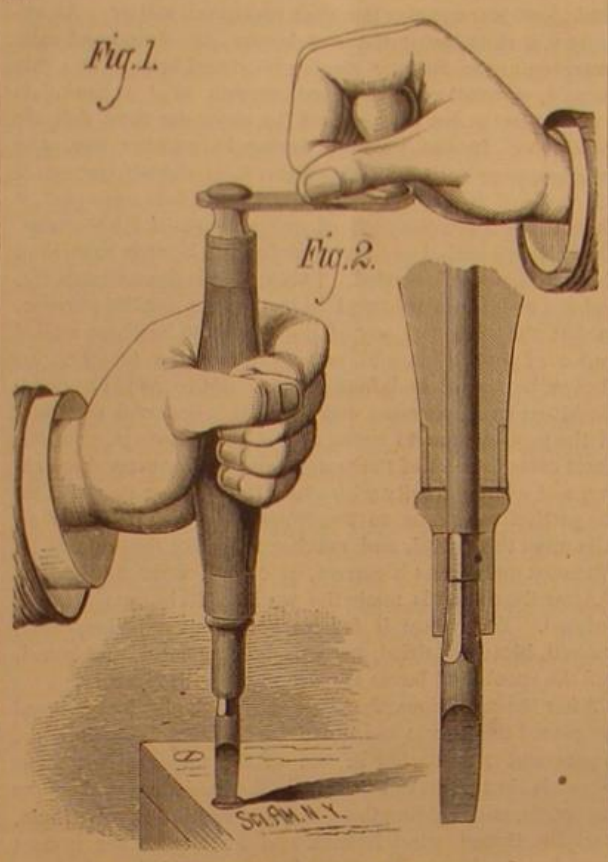
On these islands, says the London *Graphic*, where farmers suffer far more often from excess of moisture than from excess of sunshine, and where crops, which up to the last moment have promised well, are often seriously injured by wet during the process of gathering in, a successful method of artificial drying without the aid of the sun's rays would be an immense boon. For many years Mr. W. A. Gibbs, of Gillwell Park, Chingford, Essex, a gentleman engaged in mercantile pursuits in the city, and also, we may venture to observe, favorably known among the poets of the day, has also devoted much attention to this hay-saving problem. By slow degrees he invented a really practicable process, which is thus described:

"Streams of hot air from the mouth of a hot blast fan, connected with a portable engine, are directed upon masses of wet hay or grain laid in open troughs, and brought in turn, by occasional lifting of forks, under the direct action of the air. By increasing the temperature of the blast it was found that the drying process could be proportionately expedited. Eventually the scheme was perfected by bringing the hot blast fan to bear upon a shed divided into two compartments by an iron partition, and having a space between the iron floor and the ground. Hot air, supplied from the hot-blast fan by means of a duct from an underground furnace, communicates with thirty-two conical perforated tubes on the floor, on which are spiked the wet corn sheaves. These tubes of course are used only for grain. The crowning success of the whole process is an atmospheric hoist, worked by the same engine as the hot blast, which elevates and sends up to the top of a stack, 22 feet high, as many as 960 sheaves per hour."

This year, owing to the unprecedented wet summer, Mr. Gibbs' invention has come to the front and been recognized by practical men as one of extreme value. He says, in a letter to the *Field*: "On Tuesday in last week I lent one of my hay driers to Mr. Ashcombe, of Sewardstone, a practical farmer of long experience and large 'holding.' He started it at 9 A.M., and in ten hours had dried and stacked the produce of ten acres, estimated at one and a half loads per acre. The total cost was £5 10*s.* for the ten acres, rather less than it would have cost to make the hay in the field, had that been possible. The hay was made from unripe, rank, weedy grass which had been perpetually rained upon; Mr. Ashcombe and his men were inexperienced in the use of the machine, and had no help from me; the hay drier was wholly uncovered, and heavy showers fell on the hay while it was being dried" Yet, in spite of these unfavorable conditions, the result was a complete success. Already several leading agriculturists, among whom is the Duke of Sutherland, have purchased these machines. The price of the large size is £350, but cheaper forms for small holdings, ranging from £50 to £90, are in use, and have done good service.

AN IMPROVED SCREW DRIVER.

The engraving given herewith represents an improved screw driver recently patented by Mr. George Abrams, of Philadelphia, Pa. It consists of a handle through which extends a shaft, having on the upper end a crank and upon the lower end a socket for receiving the screw driver bit.



ABRAMS' CRANK SCREW DRIVER.

With this tool screws may be inserted and removed with much greater facility than with the ordinary form of screw driver, as the motion is a continuous rotary one instead of intermittent.

If desired the screw driver bit may be removed and a drill or boring tool inserted in its place.

MECHANICAL INVENTIONS.

Messrs. Jacob W. Cagle and Joshua W. Nichols, of Greenville, S. C., have patented an improved press for baling cotton, hay, straw, rags, bagging, hemp, etc. It is simple in construction, convenient, rapid, and powerful in operation. It consists of certain novel features which cannot be fully described without an engraving.

An improvement in skiving machines has been patented by Mr. Charles E. Langmaid, of Stoneham, Mass. It consists in a vibrating knife that is hung upon the bed and used in connection with the usual clamps or rolls for feeding the material, and operated by mechanism, whereby the cutting is done with greater facility than heretofore, and the machine may be used for the finest work.

Mr William H. Silsby, of Chico, Cal., has patented an improved grain separator of that class in which the grain is thrashed and immediately separated from the straw by endless belts. It consists in a peculiar arrangement of parts which cannot be readily described without an engraving.

Mr John M. Whitney, of Mount Pulaski, Ill., has invented an improved windmill and pump for use in supplying water for stock and other purposes. It is so constructed that the wind wheel may be in operation so long as the wind blows with sufficient force, while the pump will operate intermittently, or only at such times as the tank or trough is empty, or nearly so.

Mr William F. Rundell, of Genoa, N. Y., has patented an improvement in mowers, which consists, first, in the construction and arrangement of a clutch for connecting the main shaft with the driving gear; second, in the peculiar arrangement of the gauge wheel for the inner end of the cutter bar with respect to the cutter bar and carrying frame; third, in the peculiar form of joint connecting the outer end of the pitman to the cutter bar; and fourth, in the peculiar construction and arrangement of the draught attachment.

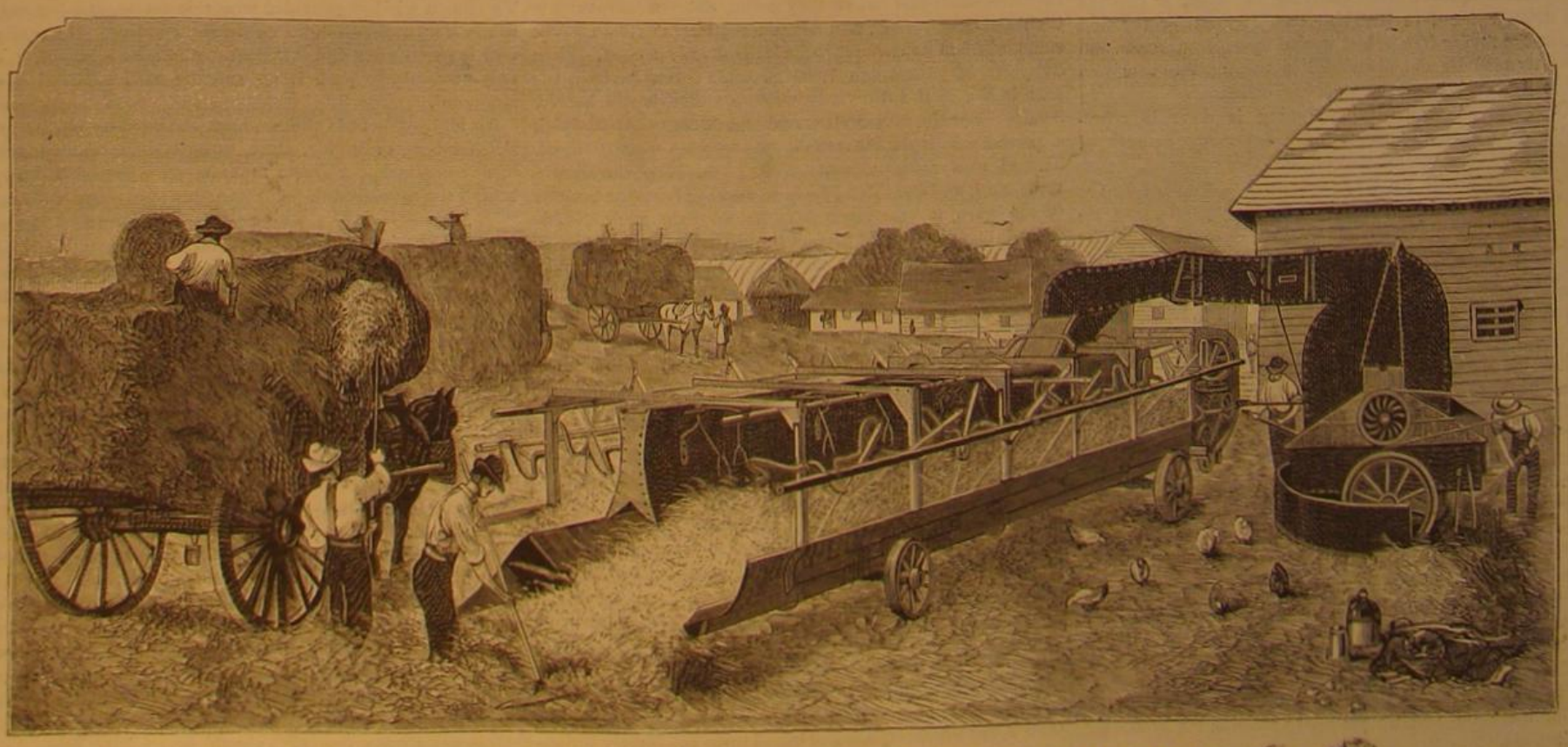
The New Cunard Steamer.

Mr John Burns, one of the proprietors of the Cunard Steamship Company, writes to the London *Times*:

"It may interest the public to know that my partners and I have just concluded a contract with Messrs. James and George Thomson by which that firm is to build on the Clyde, for our fleet, a screw steamship the size of which will be exceeded only by that of the Great Eastern, while the speed will be greater than that of any ocean steamer afloat. This new vessel will be of 7,500 tons and 10,000 horse power, her dimensions being 500 feet in length, 50 feet in breadth and 41 feet in depth, propelled by inverted direct acting compound engines, with three cylinders and seven oval tubular boilers, having thirty-eight furnaces and 1,000 feet of effective fire grate surface. She will have an extra promenade deck, and will practically be a five decker, being fitted for 450 first class and 600 steerage passengers, with accommodation for a crew of 200 officers and men. Her cargo capacity will be equal to 6,500 tons, with 1,700 tons of coal and 1,000 tons of water ballast, having a double bottom on what is called the 'longitudinal and bracket system.'

"This vessel has been designed, after lengthened consideration, to meet the requirements of our traditional service, and we have adopted in every detail of the ship and engines the most advanced scientific improvements compatible with the safe working of so great a vessel. Among the important matters into which we have crucially inquired has been that of the employment of steel instead of iron, and after a practical and thorough examination into the merits of both materials we have adopted steel for the hull and boilers, but under a provision so stringent that every plate, before acceptance, will undergo a severe and rigid test by a qualified surveyor appointed and stationed at the steel manufactory for that special purpose and that the manipulation of the steel by the builders shall be subject to an equally careful supervision by qualified engineers of our own appointment. The steel is to be made on the Siemens-Martin process, and all rivets as well as plates throughout the ship are to be of steel. The name of the new vessel is to be the Sahara, and she is to be ready for sea in March, 1881."

THE prize of $100 offered by Stillman B. Allen, of Boston, to the boy of York county, Maine, who should raise the greatest amount of corn on one-eighth of an acre this year has been awarded to Joseph Milliken, Jr., of Biddeford, who raised 1,404 pounds



CURING HAY IN WET WEATHER BY AID OF ARTIFICIAL HEAT.

THE IBEX.

Of the genus *Capra*, which includes several species, the ibex or steinbok is a familiar and excellent example.

This animal, an inhabitant of the Alps, is remarkable for the exceeding development of the horns, which are sometimes more than three feet in length, and of such extraordinary dimensions that they appear to a casual observer to be peculiarly unsuitable for an animal which traverses the craggy regions of Alpine precipices. Some writers say that these enormous horns are employed by their owners as "buffers," by which the force of a fall may be broken, and that the animal, when leaping from a great height, will alight on its horns, and by their elastic strength be guarded from the severity of a shock that would instantly kill any animal not so defended. This statement, however, is but little credited.

To hunt the ibex successfully is as hard a matter as hunting the chamois, for the ibex is to the full as wary and active an animal, and is sometimes apt to turn the tables on its pursuer, and assume an offensive deportment. Should the hunter approach too near the ibex, the animal will, as if suddenly urged by the reckless courage of despair, dash boldly forward at its foe, and strike him from the precipitous rock over which he is forced to pass. The difficulty of the chase is further increased by the fact that the ibex is a remarkably endurant animal, and is capable of abstaining from food or water for a considerable time.

It lives in little bands of five or ten in number, each troop being under the command of an old male, and preserving admirable order among themselves. Their sentinel is ever on the watch, and at the slightest suspicious sound, scent, or object the warning whistle is blown, and the whole troop make instantly for the highest attainable point. Their instinct always leads them upward, an inborn "excelsior" being woven into their very natures, and as soon as they perceive danger, they invariably begin to mount toward the line of perpetual snow. The young of this animal are produced in April, and in a few hours after their birth they are strong enough to follow their parent.

The color of the ibex is a reddish brown in summer, and gray-brown in winter; a dark stripe passes along the spine and over the face, and the abdomen and interior faces of the limbs are washed with whitish-gray. The horns are covered from base to point with strongly marked transverse ridges, the number of which is variable, and is thought by some persons to denote the age of the animal. In the female the horns are not nearly so large nor so heavily ridged as in the male. The ibex is also known under the name of bouquetin.

THE IBEX.

Preservative of the Dead.

The United States Consul-General at Berlin, Mr. Kreismann, has communicated to the Department of State a new process patented in Germany for preservation of the dead. The liquid used is prepared as follows: In 3,000 grammes of boiling water are dissolved 100 grammes of alum, 25 grammes of cooking salt, 12 grammes of saltpeter, 60 grammes of potash, and 10 grammes of arsenic acid. When cool it is filtered. To 10 liters of this liquid 4 liters of glycerine and 1 liter of methylic alcohol are added. The process of embalming is by saturating and impregnating the bodies with it. From 1½ to 5 liters of the liquid are used for a body.

Volcanic Products at the Bottom of the Pacific.

The Abbé Renard and Mr. J. Murray communicated to the Geological Section of the British Association, at Sheffield, the results of an examination of the materials brought up by the Challenger's instruments from the bottom of the central Pacific. The area from which the materials submitted to the Abbé Renard were derived extends from the Sandwich Islands to 30° S. lat., having the Low Archipelago approximately in its center. Volcanic matter was found to play an important part in the formation of the bottom, being present in the form of lapilli and ashes distributed in great abundance in the "red clay," of which we have heard so much. The lapilli nearly all belong to the basaltic type, passing from felspathic basalt to allied rocks, in which the vitreous base acquires greater and greater development, until it almost entirely displaces the crystalline constituents of the basalt, when the fragments become mere glassy rocks of the basic series, generally containing some crystals of peridote, innumerable crystallites, the latter sometimes grouped in opaque granules, sometimes arranged regularly around the peridote microlites. From the forms of these volcanic fragments, which are often coated with manganese, their association with volcanic ash, and their lithological constitution, they cannot be derived from submarine flows of lava. They are rather incoherent volcanic products, or lapilli, the accumulations of which in the Pacific form a series of submarine tuffs.

One of the most remarkable facts, brought to light by these soundings in the Pacific, is the large share taken in the formation of these sedimentary deposits by palagonites, perfectly identical in lithological characters with those of Sicily, Iceland, and the Galapagos islands. Many are in fact glasses of the basic series, either consisting of sideromelane, or decomposed into a red resinoid substance. The small lapilli of two or three inches in diameter are cemented by zeolites, showing the crystalline forms of christianite. The presence of these readily alterable basic glasses at once reveals the source of the clayey matter with which they are associated, as wherever rocks of this type occur their decomposition into clay is observable.

Among the minerals present in the volcanic ash are rhombic tabular crystals of plagioclase, augite, magnetite, and a little sanidine or hornblende. It is singular that quartz grains are practically absent, in striking contrast to coast deposits. This fact, however, is not so unexpected as the formation of zeolites in the free state. Minute fibrous radiated spherules are formed in the mud, possessing the crystallographic characters of christianite.

Besides these zeolitic spherules, other crystals of the same kind occur in the form of minute prisms, and in such prodigious numbers that they make up about one third of the red clay. These and the zeolitic spherules are regarded by the authors as belonging to one mineral species, and they remark that the formation of these and of the red clay in which they are developed is easily understood if we bear in mind the lithological nature of the basic tuffs and of their products of decomposition.—*Nature.*

NATURAL HISTORY NOTES.

THE BEHEADING OF FLIES BY A WESTERN PLANT.—In the *Bulletin de la Société Botanique de France* (vol. xxiv.), says Professor Asa Gray, there is an account by M. J. Poisson of his observations upon *Mentzelia ornata* as cultivated in the Jardin des Plantes, Paris, and the very singular mode in which it causes the destruction of flies. It is so curious that the essential points of M. Poisson's communication are here recapitulated, in the hope that observations may be made in this country, either by the few who are able to cultivate this ornamental plant with success, or by those who can examine it in its native stations. It is well known that the roughness of this and some related *Loasaceæ* is owing to the stiff bristles of the surface being provided with an armature, at certain points along their length, of retrorse barbs. There are three or four whorls of these barbs, and four or five barbs to each whorl, on the larger bristles; in the smaller there is only a terminal whorl of barbs, in the manner of a glochidiate bristle. Mixed with these harpoon-like bristles are some soft ones, tipped with a capitate gland, which secrete a viscid matter attractive to insects. It appears that flies so attracted thrust in their proboscis between the thickly-set glochidiate bristles to feed upon the secretion of the glands between and below. The retrorse barbs interpose no obstacle to this; but when the proboscis is withdrawn, its dilated and cushion-like tip catches in the barbs, and holds all fast. The harder the backward pull, the firmer and more extensive the attachment to the sharp barbs. The wounded and impaled organ becomes congested and swollen, and the insect is seldom able to disengage it. Especially is this the case with the larger flies. Some perish by exhaustion; but more of them, passing round and round in a circle, and in one and the same direction, come to an end by twisting off their heads. Insects too small to be impaled on the barbs are held fast by the viscid secretions of the glands, and likewise perish. In these respects the arrangement comes under the head of those recently illustrated by Kerner, for the exclusion of unwelcome guests from the blossoms. And this may be extended to the flies also, which might reach the blossom on the wing, but are attracted rather to the glands beneath, to their own destruction. Professor Gray requests those who have good opportunities of obtaining *Mentzelia ornata*, and its much more common relative, *M. nuda*, both of which occur in the Western prairies and plains, to investigate the matter and ascertain whether this charge of cruel behavior is well founded.

CACTUS SPINES.—The spines must, says Moseley in his "Notes of a Naturalist," be a most efficient protection to the cactus from being devoured by large animals. "I have often noticed that if one approaches one's hand slowly toward some of the forms with closely set long spines, doing it with especial care to try and touch the end of one of the spines lightly without getting pricked, one's hand always does receive a sharp prick before such is expected, the distance having been miscalculated. There seems to be a special arrangement in the color of the spines in some cases, possibly intended directly to bring about an illusion, and cause animals likely to injure the plant to get pricked severely before they expect it, and thus to teach them to shun the plant. While the greater length of the spines next the surface of the plant is white, the tips are dark colored or black. The black tips are almost invisible as viewed at a good many angles against the general mass as a background. The spines look as if they ended where the white coloring ends, and the hand is advanced as if the prickles began there, and is pricked suddenly by some unseen black tip. The experiment is easily tried in any cactus house at home."

HYBRID SHAD.—Mr. Seth Green has recently called attention to the fact that it has been customary for the last four

years at the shad hatching works on the Hudson River, whenever an opportunity offered, to impregnate the spawn of the shad with the milt of the white bass. He says that these eggs have hatched out in quite as large a percentage as those impregnated with the shad milt. The young fish look very much like small shad, but their actions are so entirely different that they are readily distinguishable while in the hatching boxes. The attention of fishermen and others is particularly called to the fact that such hybrids now exist in the Hudson, and they are requested if any such be caught to make known the fact through the papers or otherwise, describing as particularly as possible the appearance, characteristics, etc., of the strange fish.

Correspondence.

EDISON'S ELECTRICAL GENERATOR.

To the Editor of the Scientific American:

The letter of Mr. Upton, on page 337, is far from being satisfactory, at least to myself, for it tends to frustrate the realization of the plans I had suggested of relieving Mr. Edison from the appearance of having put forth a preposterous claim for his electric generator. It has almost brought me into the thick of a controversy; I barely escape and reserve my valor for another day. I protest that up to this time I do not know that there is any disagreement between Mr. Edison and myself. Mr. Upton is indeed Mr. Edison's assistant, and his letter purports to be authorized, and yet I cannot find anywhere irrefragable proof that Mr. Edison is the author of the preposterous claim, or that he ever indorsed it. I believe it is best, indeed, as I did in my article on page 305, to assume, until its falsity is proved, that Mr. Edison in the matter of that preposterous claim, or anything else, has not treated with indignity the revered memories of Ohm, Faraday, and the other fathers of electricity. Mr. Edison, like myself, appears to love peace and quietness, and perhaps the guilty author of that preposterous claim will never be discovered and punished. The disagreement which so far is developed is between Mr. Upton and myself only, and it will not long continue if he will take my advice.

The matter in Mr. Upton's letter which is offered as especially pertinent to the preposterous claim is comprised in the two following sentences:

1. "The writer of the article (on page 242) simply stated that the machine was so constructed that when used at its normal capacity the exterior resistance shall be nine times as great as the internal, so that ninety per cent of the power of the current could be used outside."

2. "Yet all that was claimed in the article (page 242) was perfectly true, and has been carefully verified."

I have not been able to satisfy myself as to what are the intent and meaning of sentence 1. I cannot find out what "normal capacity" is. I cannot find out what the thing is which was simply stated; why did not Mr. Upton state it simply? Among various theories of the intent of sentence 1 which I have worked out, the most plausible is, that the sentence is a device like those terrible engines which Knickerbocker, in his history of New York, relates were employed by the ponderous Dutch warriors. This theory derives confirmation from the fact, which appears on page 308, that Mr. Upton found it a fair thing to fire, without warning, at short range, and point blank, hot shot of Calculus (!) right into a gentleman by the name of Weston.

But sentence 2 is direct, explicit, and emphatic. It is so admirable in its way that I quote it again: "Yet *all* that was *claimed* in the article was *perfectly* true, and was *carefully* verified." Now, as nothing was claimed (on 242) but what is covered by the preposterous claim, this latter is signed, sealed, and indorsed; it is represented as having been verified; it is reasserted strenuously. Did Mr. Upton pen that sentence, with the demonstration on page 305 before his eyes?

I reproduce, from page 242, the preposterous claim: "Mr. Edison claims that he realizes ninety per cent of the power applied to this machine in effective external current," and thereupon soon follows the explanation that the great economy is due to the employing of a resistance ratio of 1 : 9. For the demonstration of the fallacy of this I refer to page 305.

I might stop here, for I have said all that is required concerning the matter of the preposterous claim. Mr. Upton introduces several other and extraneous things which are calculated, like that sentence 1, to befog and lead astray the hasty reader, and I shall therefore briefly notice them. The larger part of the letter is devoted to remarks which are aimed more or less directly at myself personally. The general effect of these is substantially that of the trite retort, you're another; but I meet them in detail by pointing out that a part are intended to show that I had overlooked something important, and the rest that I use technical terms ignorantly and recklessly.

1. After a very ingenious prelude, in which I am made to take a rather funny part, the following climax is reached: "It seems never to have occurred to the doctor that it is in the power of the maker of the machine to exert this 'moral suasion' on the wire covering the armature, so that it shall be more effective and redouble its exertion when greater resistance is offered for it to overcome." Mr. Upton is correct; it really never did occur to me. But feeling that such a confession, on account of its brevity, is rather weak, I append the remarks of one whose opinions are worth their weight in diamonds, and are the delight of the world: "If so be ye overhaul yer masheen, tack on yer armycheer a leetle more wire, and make them irons, which ye call magnets, a leetle heftier, why then yer masheen will be bigger; and howbeit ye do these things, why ye'll have a bigger masheen. Bigger, did I say? No! Why? For the bearings of the observation is in the application on it." This is perhaps one of Bunsby's greatest efforts.

2. Mr. Upton neatly gets round to the remark that I deliberately state that current and foot pounds are the same, that energy is directly proportional to the current, etc., and he corrects and instructs me by remarking that "foot pounds are always measured by the square of the current," etc. Moreover, he says: "Dr. Seeley's distinction of outside from inside current seems to me ridiculous." Mr. Upton, no doubt, made himself quity merry at the discovery of all these blunders of mine. Now I reply: Mr. Upton would not have discovered those blunders unless he had been looking for them; the wish is father to the thought. I do not think anybody else has found them, or is likely to find them. When we are obliged to write in the telegramic style, as we are when limited as to time and space, we spontaneously take up abbreviated expressions which hypercritics might object to. Thus we may use the letter C for current or strength of current or energy of current, and no one but the hypercritics will misunderstand or complain unless some positive ambiguity results. Life is too short to write with a view of satisfying the hypercritics. I might quote many precedents for the expressions I used, but I content myself with a single one, for the reason that it is from an authority which, I am sure, Mr. Upton greatly respects; the authority, please understand, is not Mr. Edison: possibly it is Mr. Upton himself. If Mr. Upton will turn to page 242 he will find thereon the preposterous claim as originally propounded, and he will observe that the last two words are "external current." How is it now? Will Mr. Upton ever again say, "the distinction of outside from inside current seems to me ridiculous?"

After finishing my case, Mr. Upton goes on: "In conclusion, I may state that the methods which are employed for testing Mr. Edison's machines were fully described in a paper read by me (in August) at the Saratoga meeting of the American Association. At that time (in August), as now, full results were withheld until Mr. Edison was fully satisfied with the performance of the machine." I find in this pretty plain evidence that Mr. Edison did not—and this I have contended for from the first—put forth the preposterous claim. He had full tests in August as well as on October 11th, and of course he knew that he did not realize that 90 per cent; if he had realized it, he would have been fully satisfied with the performance of his machine, for his machine would be the greatest invention of all time.

Mr. Upton concludes by mentioning that Mr. Edison hopes soon to have a machine with a resistance ratio of 1 : 20. I trust this is not quite true. It would be almost a public calamity if Mr. Edison should employ his great talent on such a puerility. I quote again: "His machine is so made that it would be impossible to use it with the same resistance outside as inside, as it would heat the wire on the armature so as almost to burn it, by carrying a current so much in excess of that for which it was intended." The truth of this must be evident to any one who is a tolerable expert on machines; but I quote it as further evidence that Mr. Edison is not the author of the preposterous claim, and to raise the query whether we cannot relieve Mr. Upton also from suspicion.

A few weeks since (suppose) the startling announcement was made in the papers that X, a dear and distinguished friend of mine, had lifted himself over a tall fence by pulling on his boot straps. Many respectable people, influenced mainly by their exalted and often proved faith in the ability of X, accepted the announcement as true; for my friend was an eminent authority and exceedingly expert in the matters relating to the alleged achievement. The hopeful people at once began speculations on the applications of X's discovery to rapid transit and other great projects. The larger part of the community, however, remembering something of the little lessons in natural philosophy of their school days, denied the claims set up for X, and they scoffed at him. At this juncture it seemed to me a proper thing and a duty towards a friend and to the public to make an explanation. I said that the feat proclaimed was really an impossibility, that it was a contradiction of the law of action and reaction; that the pulling up on the boot strap would be precisely balanced by the pressing down of the feet in the boots, etc.; that my friend was of too good sense to claim impossible performances; that the announcement was an exaggeration, or came from a wicked partner, etc. My explanation was calculated to pacify the scoffers and to make all lovely again. My friend had no call to say anything, unless to indorse my explanation or to turn the whole affair into mild but pleasing entertainment by relating how the announcement originated in a little badinage of his, in which he proposed to lift himself over the fence, by pulling on the boot straps of his carriage after slinging them over a pulley, etc. But the affair is going to terminate differently and sadly. For a gentleman by the name of Z, who is an assistant (some say a partner) of X, has written a letter to the public which purports to be authorized by X, in which the original claim is reasserted and enlarged. Mr. Z says: 'Spring, at its normal capacity, is the pleasantest season of the year. X never denied Newton's laws. Yet all that was claimed in the papers was perfectly true, and has been carefully verified. X has positively lifted himself over a fence ten feet high, and it may be mentioned that he hopes to lift himself over a fence 20 feet high. There are doors in the fence, but they have patent locks on them. (What does this mean?) This S isn't much of a doctor, and I wouldn't trust him with a sick cat. He spells Jerusalem with a G, and his name is mentioned in connection with a neighbor's hen roost." This letter of Z's is a great trouble to us, but I protest and persist that X is innocent. No one can foretell what is to come out of all this embarrassment.

But all this is supposition. Perhaps it isn't apropos of anything. "The bearings of an observation is in the applications on it."

CHARLES A. SEELEY.

A Note from Mr. Edison.—The Hughes Microphone and the Blake Transmitter.

To the Editor of the Scientific American:

In reference to the communication from T. D. Lockwood, which appeared in the SCIENTIFIC AMERICAN (No. 21), November 22, 1879, regarding the carbon telephone, I wish to say that his statement that the scientific men of Europe have supported the claim of Hughes that the microphonic action is different from the carbon telephone, is absolutely false, and as a fact just the contrary is the case. Also that the Patent Office has declared that the Blake transmitter filed in the Patent Office in 1879 infringes several of my patents filed in 1877. In fact there is not the slightest difference between the carbon transmitter and the so-called Blake transmitter, except in size of parts and delicacy of adjustment.

T. A. EDISON.

Menlo Park, N. J., November, 1879.

CROSS-BREEDING AMONG FISH.

Mr. Robert B. Roosevelt, so well known in connection with fish breeding, is responsible for some surprising assertions with regard to the inter-crossing of distinct species of fish. Some two years ago the eggs of a shad were placed in a pan of fresh water which could not have contained any milt of the male shad. This done, the eggs were mixed with the milt of a striped bass and they were immediately fertilized. They were then placed in the shad-hatching boxes, and fully 10,000 young cross-breeds were the result. They were turned into the river at the proper time, and it is not yet time for them to return, if they follow the customs of their mother.

That the hybrids are likely to thrive and breed is thought probable after the perfect success that has followed the crossing of the California salmon and the common brook trout. Mr. Roosevelt says: "We have crossed fifteen or twenty different breeds, and all successfully, and I can assure you that the result is a strong argument in favor of Darwinism, for it shows that all fish may possibly have grown out of one or two varieties. This would account for what is called the 'land-locked salmon' which is found in lakes having no communication with the sea. The object of this crossing and breeding is to improve the fish, just as they cross neat cattle and horses, and even fruits and flowers. The result will be to make fish food plenty, and to add a large number of 'queer fish' to the number already in existence."

THE INTERNATIONAL DAIRY FAIR.

The second annual International Dairy Fair in this city, to be opened in the American Institute building, December 8, promises to be the largest and finest exhibition of the kind ever held in this country. Nearly three thousand entries have already been made by intending exhibitors, and ten thousand dollars will be given as premiums. It is expected that at least 300 specimens of fine cattle will be exhibited, representing the most celebrated herds in the country. Especial attention will be given to this department of the fair. In addition to many novelties there is promised an elaborate comparison of the methods of butter and cheese manufacture as employed a hundred years ago and to-day in our best factories.

STEAM TOWING ON THE ERIE CANAL.

The first through tow on the Erie Canal from Buffalo to Rochester, by the steam cable towing system, arrived at the latter city, November 18. The tow consisted of five canal boats, carrying 1,200 tons of grain. The distance, 96 miles was covered in 39 hours, a saving of 23 hours as compared with horse power. It is expected that the cable system will be completed the entire distance from Buffalo to Troy, 345 miles, shortly after the reopening of navigation in the spring. The existing canal boats will be used without alteration, and the boats will yield a larger revenue owing to the saving of time on each trip. The traffic of the canal this year has been unusually great, and it is expected that the new system will largely increase its capacity.

New Military Projectile.

Experiments have recently been carried on at Grenoble to test the efficacy of a new apparatus, made by M. Lamarre. The invention consists of balls to be projected by guns of a fortress for the purpose of throwing a strong light on the enemy's position during the night; the principal object being to prevent the digging of trenches or the performance of other military operations. Shortly after leaving the cannon, the Lamarre fire ball discharges a light sufficiently bright, and lasts long enough, to enable guns to be pointed at the works. The projectile is, moreover, provided with a grenade, which explodes after a certain time, and is designed to keep the enemy's troops away and prevent them from putting out the unwelcome light.

GLASS TUBING.

The manufacture of glass tubing is surprisingly simple. The glass blower takes a small quantity of melted glass from the pot with his blowing tube, rolls it slightly on a marble slab to give it a cylindrical form, he then adds a small quantity of glass from the same pot, and blows the enlarged mass while rolling it, taking great pains to keep the shape cylindrical. If tubes of large caliber are required, the inside diameter of the cylinder is enlarged, and the glass is allowed to cool slightly before drawing. For tubes of very small caliber, such as thermometer tubes and other capillary tubes, the internal diameter of the cylinder is decreased and the glass is used very warm.

In making a piece of glass tubing the assistant places a ball of glass against the end of the glass cylinder by aid of his blowing tube. Now the men, each holding an end of the glass cylinder by means of their blowing tubes, begin to separate, walking backward. The cylinder is thus lengthened, and at the same time made smaller in diameter, and the diameter, of course, depends upon how much the tube is drawn out.

When the tube has attained the right size it is generally too warm and soft to admit of laying it down without destroying its shape; it is therefore cooled by means of a fan, as shown in Fig. 1. When it becomes sufficiently cool it is laid upon a series of equidistant parallel wooden blocks of uniform height, where it remains until it becomes cold. It is then cut into lengths with a diamond or a file. If the tubes are to resist great pressure or changes of temperature, they are annealed with great care. They are sometimes plunged into boiling linseed oil and slowly cooled.

FIG. 1.—COOLING GLASS TUBES.

Reading Room of the British Museum.

The dome of the British Museum reading room, in which the electric light is now used, is 140 feet in diameter and 106 feet high. In this dimension of diameter it is only inferior to the Pantheon of Rome by 2 feet; St. Peter's being only 139; Sta. Maria, in Florence, 139; the capitol at Washington, 135½; the tomb of Mahomet, Bejapore, 135; St. Paul's, 112; St. Sophia, Constantinople, 107, and the Church at Darmstadt, 105.

The new reading room contains 1,250,000 cubic feet of space; its "suburbs," or surrounding libraries, 750,000. The building is constructed principally of iron, with brick arches between the main ribs, supported by twenty iron piers, having a sectional area of 10 superficial feet to each, including the brick casing, or 200 feet in all. This saving of space by the use of iron is remarkable, the piers of support on which the dome rests only thus occupying 200 feet, whereas the piers of the Pantheon of Rome fill 7,477 feet of area, and those of the tomb of Mahomet 5,593 feet. Upwards of 2,000 tons of iron have been employed in the construction. The weight of the materials used in the dome is about 4,200 tons, namely, upwards of 200 tons on each pier.

The uprights or standards of the bookcases in the British Museum reading room are formed of wrought iron, galvanized and framed together, having fillets of beech inserted between the iron to receive the brass pins upon which the shelves rest. The framework of the bookcases forms the support for the iron perforated floors of the gallery avenues, and which are generally 8 feet wide, the central 6 feet being appropriated to the perforated floor, and the remainder being a clear space between the back of the books and the flooring, by which contrivance the light from the skylights (in all cases extending to the full width of the avenues) is thrown down the back of the books on each story, so that the lettering may be easily discerned throughout the book ranges. The shelves are formed of iron galvanized plates, edged with wainscot and covered with russet hide leather, and having a book fall attached. They are fitted at each end wih galvanized iron leather, covered, and wadded pads placed next the skeleton bookcase framing, to prevent injury to the binding when the books are taken out or replaced. Between these pads the skeleton framing of the cases forms an aperture by which a current of air may pass and ventilation be kept up throughout. The shelves rest upon brass pins, the holes for which are pierced at three quarters of an inch apart from center to center; but by a contrivance in cranking the shaft of the pin, which may be turned upward or downward, this interval is practically halved, and the position of the shelves may be altered three-eighths of an inch at a time.

The reading room contains three miles lineal of bookcases, eight feet high; assuming them all to be spaced for the averaged octavo book size, the entire ranges form twenty-five miles of shelves. Assuming the shelves to be filled with books, of paper of average thickness, the leaves placed edge to edge would extend about 25,000 miles, or more than three times the diameter of the globe!

Slag Boiler Covering.

Mr. Franz Buttgenbach, the well known metallurgist, gives the following method for the utilization of blast furnace cinder as an insulator for steam pipes, etc.: Mix 150 parts of cinder dust, 35 parts by weight of fine coal dust, 250 parts of fire clay, and 300 parts flue dust, with 10 parts of cow's hair, add 600 parts of water into which 10 to 15 parts of raw sulphuric acid has been poured, and make a stiff dough of the whole. This is thrown in small amounts upon the warmed pipe, hardening rapidly. Upon this rough coat a second, third, etc., is laid, according to the thickness which is to be used. By the action of sulphuric acid gypsum is formed, and the silica, rendered free, hardens. The mass becomes as hard as porcelain, and is still porous. It adheres firmly, and never cracks. Mr. Buttgenbach states that he has tested its merits by ten years' use, and has found it to meet all requirements.

AGRICULTURAL INVENTIONS.

An improvement in sulky-plows has been patented by Mr. William J. Meharry, of State Line, Indiana (Sheldon, Illinois, P. O.). The object of this invention is to furnish an improved sulky attachment for plows, which shall be simple in construction, may be readily attached to any ordinary plow, will materially lighten the draught, and will allow the plow to be readily controlled.

Messrs. John J. Howell and Osnel H. Wienges, of Fort Motte, S. C., have invented an improved handle, which is so constructed that it may be applied to hoes, rakes, and other similar garden and farm implements, and which may be easily and quickly detached from one implement and attached to another, and when attached will hold the implement firmly and securely.

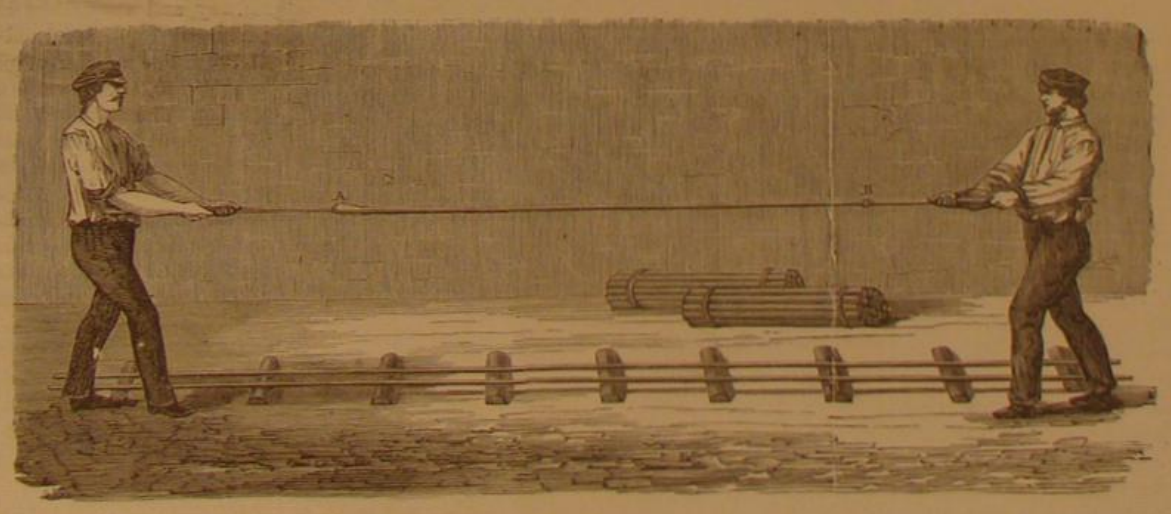


FIG. 2.—DRAWING GLASS TUBES.

An improved farm gate has been patented by Mr. George Johnson, of Waucousta, Wis. This is an improvement in the class of horizontally swinging farm-gates, which have suitable attachments for holding them at different elevations for the purpose of avoiding snow or other obstruction, while being opened or closed. The invention relates to the construction of the attachments or devices which hold the gate in different vertical adjustments.

NEARSIGHTEDNESS AND THE COLOR OF THE EYES.—M. Nicaté stated, at the meeting of the French Society for the Advancement of Science, that as one of the results of his examination of 3,434 eyes in relation to myopia, at Marseilles, this defect was observed far more frequently in light than in dark eyes, blue and gray eyes furnishing 18 per cent, and black and brown eyes only 11·27 per cent.

Purifying Gelatine.

Impurities in gelatine may be classified under two heads—mechanical and chemical—the latter being far more difficult to remove than the former, inasmuch as they are more or less in combination with the material itself. Fortunately they do not appear to exert the same injurious action on the emulsion as the mechanical, which, although simply in a state of suspension, are yet exceedingly difficult to remove by simple filtration, especially after the emulsion is formed, as many of them are in quite as fine a state of division as the bromide itself; hence it is clear that any means which may be adopted to remove the one will also remove the other.

The mechanical impurities in gelatine principally consist of lime in the form either of the sulphates, carbonates, and phosphates, fat or grease, sometimes animal fiber, and always that very indefinite compound "dust." This latter impurity is generally present in considerable quantity owing to the sheets or flakes, while in the jellied form, being exposed on nets of string or wire in a strong current of air to dry, when, as a matter of course, any dust that comes in contact with them adheres and dries into the gelatine. In some of the English manufactories wire nets are employed, but on the continent those made of string are principally in use, and fibers of that material adhere to and are detached with the gelatine. It is said that these nets are greased to prevent the flakes from sticking. If this be the case it will account for some of the fat generally present in gelatine. We are told that it is the custom with some of the continental manufacturers to wash the surface of the sheets of their finest kinds with warm water after they are dry so as to remove the extraneous surface matter.

Although, as we have said, it is almost impossible to remove the insoluble matter by mere filtration, owing to the viscousness of the solution, yet it may be entirely eliminated by adopting the process commonly employed in the culinary art for clarifying jellies. This consists of mixing with the solution of gelatine some albumen of white of egg, and then raising the temperature sufficiently high to coagulate the albumen, which in coagulating imprisons the insoluble particles. The whole is then put into a flannel bag, and suspended in front of a fire, when the solution passes through perfectly clear and transparent, even if an opaque sample of gelatine have been used, and at the same time all fatty particles will be retained by the coagulated albumen. In practice, however, it will be found very difficult to treat successfully thick solutions in this way, as they will not pass through the strainer in the same manner as thin ones, such as are used for jellies, and also that strong solutions set much quicker and at a higher temperature than weak ones, so that some other plan must be adopted to avoid the necessity of filtering the solution if a strong one require purification.

The method we have employed with perfect success does not require filtration at all, yet the solution is rendered perfectly bright and transparent, and free from all solid particles as well as fatty matters. For this purpose the gelatine to be purified is placed in cold water until it has become swollen. It is then transferred to a beaker placed in a water bath heated to a temperature of 110° Fah. —not higher—until it is dissolved; then some well-whisked white of egg is stirred in. The proportion we have used has been two ounces of albumen to each four or five ounces of dry gelatine. Now, with a whisk, or, better still, one of the American egg beaters, convert the whole into froth. To do this easily it may be necessary to heat the solution somewhat, so as to render it more limpid; but care must be taken that it does not rise beyond 120° Fah., otherwise the albumen will be coagulated before its time. After the whole is converted into froth the temperature of the water bath must be quickly raised to nearly boiling point, and then allowed to remain undisturbed for some time.

As the albumen coagulates it will rise to the surface of the solution, carrying with it all the solid impurities, leaving the lower part quite clear. This may take some little time, according to the strength of the solution; but the temperature must be maintained until it is clear. It may then be allowed to cool, and the whole turned out (which may be easily done by placing the beaker in water for a few seconds and then inverting it), and the top part cut off and rejected. The other part may then be used direct for the emulsion, or it may be cut into thin slices and dried in an atmosphere free

from dust, and preserved for future use. The drying may be much facilitated by digesting the thin slices in strong alcohol, so as to displace the greater part of the water before commencing to dry, and by this means the chances of its becoming contaminated with dust will be much reduced.

The object of converting the greater part of the solution into froth is this: If the albumen was simply stirred in and then coagulated it would remain in suspension, owing to the density of the solution; but, when the whole is converted into froth, the air bubbles as they rise to the surface carry the coagulated albumen, together with its imprisoned impurities, before it. As an example of the efficacy of this method of purification we may mention that we once mixed some gelatine with a solution of Indian ink which had been passed through filtering paper, and then treated it in the manner described, the result being that the whole of the coloring matter was removed with the albumen, which floated on the top like soot, while the lower portion was not only transparent, but perfectly devoid of color.

This experiment not only proves the efficiency of the process, but also shows that it is impracticable to purify the emulsion with albumen after it is made, as has been suggested, for the purpose of removing the coarser particles of bromide, because the whole would be removed in the same manner as the coloring matter of the Indian ink was.—*British Journal of Photography.*

Letters Patent.—How and in What Manner they can be Taken Out.

In this age of improvements and inventions the subject of patents is of great interest. The laws which govern patents are among the most important on the statute books looking to the protection of industries, as they grant inventors, their heirs and assigns, the exclusive right for a specified period to new discoveries and inventions of a novel and useful character. Every invention or discovery to be patentable must possess the merit of either novelty or utility. A patent will not be granted to an applicant for an article discovered and invented by another, but inventors will not prejudice their rights by allowing the public sale of that invention for two years before applying for a patent, and a valid patent will not be issued in case this use extends over a longer period. A "prior invention" does not hold good, if the party has simply conceived the idea of the thing patented; it is necessary that it should be reduced to a practical form or complete invention before a claim can be established. Whoever restores an abandoned or lost art or invention may obtain a patent for it.

An invention patented in a foreign country can receive a patent in the United States, if it has not been in public use two years prior to the application, but the American patent will not continue beyond the time granted by the foreign patent. In determining

WHETHER AN INVENTION IS NEW,

it is only necessary to ascertain if it is different from anything previously patented. In deciding the question of novelty it is necessary to decide whether an invention is really novel, or whether it consists in a double or analogous use of something already known. For instance, a patent will not be issued to a person who first applies to railroad cars a kind of a wheel previously used for other conveyances. Neither can the discovery of a principle, a natural law, scientific truth, or property of matter be a subject of a patent. But whoever makes a new and useful application of any of these things by embodying the principle of the law in mechanism, or describing a new process by which the discovery may be of practical utility, may obtain a patent for his invention, which consists not in the abstract principle, but in its practical application.

Persons wishing to obtain letters patent usually apply to a solicitor of patents or attorney, and furnish him with a model of the invention desired to be patented, except in cases of designs, compositions, and processes. The petitioner takes oath that he believes himself to be the original and first inventor of the invention, and that, to his knowledge, it has not been known or used before. Accompanying this petition and oath must be a model of the invention if the case will admit of it, with drawings and specifications. The application must be signed by the inventor unless he is dead, when it must be signed by his executor or administrator. The specification is a full description of the invention, in writing, and the manner and process of making and using it. The description is followed by the claim, in which the applicant must particularly specify the part, improvement, or combination which he claims as his own invention and discovery. Where there are drawings the specification must refer by letters and figures to the different parts. In the case of the composition of matter, specimens of the composition and of the ingredients sufficient in quantity for the purpose of experiment must accompany the application.

THE CHIEF OBJECTS OF THE SPECIFICATIONS

Are to make known the precise nature of the invention, and to enable the public from the specification itself to practice the invention after the expiration of the patent. The object of the claim is to fix with accuracy the extent of what is claimed as new. It is sometimes fatal to a claim to call an invention a machine when it is a process, and it is of the utmost importance to the inventors that the specifications are plain. The petition, oath, model, specification, drawing, etc., are forwarded to the Patent Office at Washington by the solicitor or attorney. The Patent Office, as those who have seen it are well aware, is one of the most notable buildings in the nation's capital, as it is one of the most important. Here are preserved all records, books, models, drawings, specifications, etc., pertaining to patents. The office is under the supervision of the Secretary of the Interior, but the Commissioner of Patents is the chief in charge of the office. The officers consist of a commissioner, assistant commissioner, and three examiners-in-chief, besides one chief clerk and examiner in charge of interferences, and a host of primary examiners. These primary examiners are men versed in some special department of mechanics, etc., and models, drawings, specifications, etc., are given to them for examination, with due reference to their special qualifications.

If an applicant is dissatisfied with a decision, he can be heard by the board of examiners-in-chief, and then, if still dissatisfied, before the Commissioner on appeal. Appeals from the Commissioner can be taken in all cases, except interferences, to the Supreme Court. Where an inventor is not ready to file a complete specification, and desires further time, but wishes to secure his right, he can file a caveat, which will be placed in the secret archives of the Patent Office; and if there be any application within a year for anything which appears to interfere with his claim, he shall have notice, and may appear and prove priority; and by a second caveat he may renew it for another year. Patents can be procured in foreign countries, and a great many are taken out in England, Canada, France, Belgium, and Germany.

THE PATENT OFFICE IN WASHINGTON

Is more than self-supporting, and to-day is said to have at least $1,000,000 to its credit. Last year there were 20,260 applicants for patents, and 12,354 patents were granted, besides 1,455 trade marks and 492 labels. Of the patents, 832 were held for the final payment of dues. The cost of obtaining a patent is usually about $60, $25 of this amount being the fee of the solicitor and the balance is paid at the Patent Office. The State receiving the largest number of patents per capita last year was Nevada, but usually the order is as follows: Massachusetts, Connecticut, Rhode Island, New York, and the District of Columbia. It is to be expected that Massachusetts and Connecticut will stand at the head of the list. The intuitive ingenuity of the Yankee is constantly designing something new and exploring the labyrinths of science and art in its efforts to lighten the labor of man, and it will be a long time before he can be ousted from his position at the head of designers and inventors.—*Boston Globe.*

Fire Losses.

The statistics of fires for the month of September show that the losses by fires reported in the United States amounted to $5,349,300, and in Canada to $264,800. Of the United States loss, the insurance companies paid $2,298,200, and of the Canadian loss $165,000, or less than one half. The loss for the corresponding month of last year was $790,500 less than the aggregate amount above given. This total loss of $5,349,300 was distributed, says the *Fireman's Journal*, generally throughout the States and Territories, New York State suffering the most severely, her loss being $767,700; Illinois comes next, with a loss of $439,600; Iowa lost $322,500, and Massachusetts $281,600. Dakota had an exceptional fire at Deadwood, where the loss was $1,070,000, which is not included in the classification of average losses. For the nine months ending with September, the recorded losses of the United States amounted to $61,159,100, and in Canada to $6,014,800—an aggregate of $67,164,900. The aggregate losses for the same period last year were $50,626,500, showing a gain for 1879 of $16,538,400. Should the last three months of the year only equal for each the loss of September, the recorded loss for the year will be $84,007,200. But it is estimated that one third of the actual losses are not recorded, so that the estimate heretofore made that the annual loss by fire is $100,000,000 is not far out of the way.

The statistics for the past ten years show, excepting great conflagrations, a yearly increase in the fire losses of the country. This is positive demonstration that the means for controlling fires have not kept pace with the building operations of the country. Including the great conflagrations, the fact becomes apparent that improvement in fire extinguishing machinery has not kept pace with the latest methods of construction. As a matter of fact, the means for fighting fires in the seven, eight, or nine story buildings of modern times, constructed of the most inflammable material, are no better than they were twenty years ago, before the era of tall buildings, and when better methods of construction prevailed. The steam fire engine is the only real advance in fire extinguishing machinery that has been made within the present generation, and the capacity of these has not been increased to accord with the modern style of architecture. Machinery that is equal to fighting a fire in a three story building is wholly ineffectual when the flames are raging a hundred or more feet above the street level. That our engines have not greater capacity is not the fault of the manufacturers. The demand has been for light engines that could be quickly drawn to a fire, rather than for those of great capacity in throwing water. As a matter of fact, the light engines are more serviceable three times out of five. It is only in those cities where tall buildings are numerous that more powerful engines are required, and in those greater importance is laid upon the ability of the lighter ones to get quickly to a fire and put it out before it gets headway, than upon great volumes of water to suppress one that is well agoing. Preventions of conflagrations, rather than their extinction, is relied upon. This would be all well enough if it could always be trusted. But conflagrations will come in spite of every precaution, and, in such an emergency, the engine that can throw the greatest volume of water steadily for all the time required is the best one.

But to return to the statistics, which show an annual waste of $100,000,000 of property every year. This amount of actual values, the product of the people's industry, is thrown away yearly. There is no return for it in any shape. Insurance companies may make good individual losses, but the money must come from the pockets of other individuals, and, eventually, is paid by the producing classes. It would be far better if we could take $100,000,000 a year in new, crisp, greenbacks from the National Treasury and burn them up, if by that means we could save for business purposes the property destroyed by fire. But suppose Congress should appropriate this sum of money to be burned up every year—what a howl of indignation would be raised by the taxpayers of the country! How they would denounce the wastefulness of our legislators, and how quickly they would relegate them to private life. But would it be any worse for Congress to thus squander the substance of the nation than it is for the careless and wasteful taxpayers to do it? The waste is the same, and careful and prudent taxpayers are forced to contribute to make up the losses of those who are neither the one nor the other. What we want is better legislation to control the erection of buildings, and legislation to prevent insurance companies from encouraging incendiarism by paying more for property that is destroyed by fire than it was worth while standing. In other words, the payment of losses by insurance companies should be restricted to two-thirds the value of the property destroyed. With such a law in force, property owners would be compelled to carry one-third of the risk themselves, and this would destroy all motive to incendiarism, and induce prudence and care in the management of property. Such a law enforced rigidly in every State would reduce our fire losses more than fifty per cent the first year.

Telegraphy in France.

By the end of the present year, of 87 chief towns of departments, only 26 will not be provided with direct telegraphic communication with Paris. These 26 towns communicate through intermediate offices. The total number of direct wires from the French capital to provincial centers is 113, and several of these centers have more than one such wire. Thus, Amiens has 2; Bordeaux, 3; Marseilles, 4; Montpellier, 2; Nantes, 2; Toulouse, 2; Trouville, 2; and Versailles, 39. Twenty-five of these lines are subterranean. As regards direct wires to foreign centers, Paris has one to Amsterdam, one to Antwerp, one to Basle, three to Berlin, one to Berne, one to Bergeux, three to Brussels, one to Cologne, one to Florence, one to Geneva, nine to London, one to Metz-Hamburg, one to Milan, one to Mülhausen, one to Rome, one to Strasbourg, one to Turin, and two to Vienna. There is also a direct submarine wire from Marseilles to London.

The Telegraphic System of the World.

The system of telegraphs in Europe comprised, at the end of 1877, 268,809 miles of lines, and 769,768 miles of wires. There were 19,627 government telegraph stations, and 12,708 railway and special stations. The number of employés amounted to 61,984,. and the number of instruments to 41,708. The number of paid messages was, in round numbers, 86,000,000, of which 20,000,000 were international dispatches. The number of other telegrams forwarded amounted to about 7,000,000. M. Newman Spallart gives the following statistics for the other parts of the world. In America (1875 to 1877), 114,157 miles of wires; 8,756 stations; 23,000,000 telegrams. In Asia (1875 to 1876), 24,521 miles of wires; 489 stations; 2,300,000 telegrams. Australia (1875), 23,582 miles of wires; 689 stations; 2,500,000 telegrams. Africa (1874 to 1876), 8,148 miles of wires; 196 stations; 1,200,000 telegrams.

A New Colorado Mining Tunnel.

The Boulder *News and Courier* says: "A tunnel has recently been started at the base of Seaton Mountain, about one mile from Idaho Springs, having a course north 24° east. It cuts at right angles all the lodes, and some of them at a depth of 2,300 feet. Thirty-seven already discovered will be cut by this tunnel, many of them well and favorably known by their rich and abundant production of ores. Of these, the projector of the enterprise has secured thirty-four lodes, and arranged for the purchase of the balance when desirable, thus wisely avoiding any possibility of dispute over titles, surface claims, or side lines in the long hereafter. This tunnel, christened the 'Idaho,' is considered in many respects the largest and best constructed tunnel in the country for mining uses. Bed rock was reached at a distance of 48 feet, at which point the first lode was cut, the vein matter assaying well. Very strong and promising mineral veins have been cut within each successive 25 feet since reaching solid rock. This tunnel, if continued on its course, will reach Black Hawk at a distance of three and a half miles."

MEN of science, students, inventors, and every other class of persons desirous of keeping up with the times should become regular subscribers to this paper. They will find it a paying investment, for the SCIENTIFIC AMERICAN not only contains a record of all the important discoveries and inventions of this country, Great Britain, and other English speaking countries, but translations from the French, German, and other foreign scientific and industrial publications, nearly all of which are received regularly at this office.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Blake Crushers, all sizes, with all the best improvements, at less than half former prices. E. S. Blake & Co., Pittsburg, Pa.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 333.

To Thrashing Machine Manufacturers.—The best, cheapest, and most durable Grain Tally. Can be attached to separators. Measures and registers correctly. Shop rights or entire patent for sale. Address A. H. Seavey, North Huron, Wayne Co., N. Y.

Agency Wanted to introduce some Novelty into Canada by a gentleman of ability. Address "Novelty," Aylmer, Ont.

The Friction Clutch Captain will start calender rolls for rubber, brass, or paper without shock; stop quick, and will save machinery from breaking. D. Frisbie & Co., New Haven, Conn.

Flanges, Pulleys, etc. P. Pryibil, 467 W. 40th St., N. Y.

You can get your engravings made by the Photo-Engraving Co. (Moss' process), 67 Park Place, N. Y., for about one-half the price charged for wood cuts. Send stamp for illustrated circular.

Hoisting Machinery of all kinds a specialty.

Castings of Crucible Steel, solid, act same as bar steel. Specialty: Cast Cast Steel Plow Shares. Agricultural Wrought Steels of every description. Write us. Read, McKee & Co., limited, Pittsburg, Pa.

For Sale.—Patent Automatic Planer Knife and Tool Grinder. Also Patent Friction Clutch and Pulley. Address E. S. Fernald, Saco, Me.

A Firm in Scotland, representing a New York Leather Belting House, are anxious to obtain another representation for American goods. Address B. J. H., P. O. Box 2701, New York.

Presses, and Dies that cut 500,000 fruit can tops without sharpening. Ayar Machine Works, Salem, N. J.

For Sale.—One Horizontal Steam Engine, 20″ x 48″; one 18″ x 42″; one 16″ x 36″. Atlantic Steam Engine Works, Brooklyn, N. Y.

Wood Turning Lathes. P. Pryibil, 467 W. 40th St., N.Y.

Light and Fine Machinery contracted for. Foot Lathe Catalogue for stamp. Chase & Woodman, Newark, N. J.

Empire Gum Core Packing is reliable; beware of imitations called Phœnix. Greene, Tweed & Co., 18 Park Place, N. Y.

Box-bell, $1.50. Bell, Battery, and Push Button, $3. All first-class. H. Thau, 128 Fulton St., N. Y.

Situation Wanted.—Have had ten years' experience as mechanical superintendent of a large sewing machine business. Understand mechanical drawing, tool making, etc. Best of references. Particulars by letters. Address K., Box 254, Guelph, Ontario, Canada.

The Genuine Asbestos Steam Pipe and Boiler Coverings are the most durable, effective, and economical of any in use. H. W. Johns Manufacturing Company, 87 Maiden Lane, New York, are the sole manufacturers.

A Gentleman, now Foreman in a large Manufactory, possessing inventive ideas, a first-class draughtsman, theoretical and practical machinist, desires to change his present position for one in which he may have a better chance to employ his skill in all kinds of scientific or industrial machinery. Address, for ten days, F. Lambert, 365 12th St., South Brooklyn, N. Y.

See Staples & Co.'s advertisement of Non-Congealable Lubricating Oils on inside page.

Metallic Articles Colored in Single or Rainbow Colors. New Process. High cost metals imitated in cheaper metals. Gardiner M'f'g Co., Newburyport, Mass.

For best Fixtures to run Sewing Machines by Power, address Jos. A. Sawyer & Son, Worcester, Mass.

Thomas D. Stetson, 23 Murray St., New York, serves as Expert in Patent Suits.

The Baker Blower ventilates silver mines 2,000 feet deep. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Wheelbarrows.—The "A. B. C. bolted" will outlast five ordinary barrows. $24 per doz. A. B. Cohn, 197 Water St., N. Y.

Park Benjamin's Expert Office, Box 1009, N. Y. Recipes and information on all industrial processes.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

The Secret Key to Health.—The Science of Life, or Self-Preservation. 300 pages. Price, only $1. Contains fifty valuable prescriptions, either one of which is worth more than ten times the price of the book. Illustrated sample sent on receipt of 6 cents for postage. Address Dr. W. H. Parker, 4 Bulfinch St., Boston, Mass.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Steam Excavators. J. Souther & Co., 12 P.O. Sq. Boston.

Bradley's cushioned helve hammers. See illus. ad. p. 302.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery. Send for descriptive catalogue to Rowley & Hermance, Williamsport, Pa.

Eclipse Portable Engine. See illustrated adv., p. 318.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 269.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Latest improved methods for working hard or soft metals, grinding long knives, tools, etc. Portable Chuck Jaws and Diamond Tools. Address American Twist Drill Co., Woonsocket, R. I.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Eagle Anvils, 9 cents per pound. Fully warranted.

Repairs to Corliss Engines a specialty. L. B. Flanders Machine Works, Philadelphia, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 30.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn

$400 Vertical Engine, 30 H. P. See page 350.

No gum! No grit! No acid! Anti-Corrosive Cylinder Oil is the best in the world, and the first and only oil that perfectly lubricates a railroad locomotive cylinder, doing it with half the quantity required of best lard or tallow, giving increased power and less wear to machinery, with entire freedom from gum, stain, or corrosion of any sort, and it is equally superior for all steam cylinders or heavy work where body or cooling qualities are indispensable. A fair trial insures its continued use. Address E. H. Kellogg, sole manufacturer, 17 Cedar St., New York.

Emery Wheels for various purposes, and Machines at reduced prices. Lehigh Valley Emery Wheel Company, Weissport, Pa.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville N. J

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with small capital. Send stamp for 80 page illustrated catalogue. McAllister, Manufacturing Optician, 49 Nassau St., New York.

Patent Steam Cranes. See illus. adv., page 351

National Steam Pump. Simple, reliable, durable. Send for catalogue. W. E. Kelly, New Brunswick, N. J.

Renshaw's Ratchet (short spindle) uses taper and square shank drills. Pratt & Whitney Co., Hartford, Ct.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 349.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Steam Engines, Automatic and Slide Valve; also Boilers. Woodbury, Booth & Pryor, Rochester, N. Y. See illustrated advertisement, page 285.

Microscopes, Optical Instrm'ts, etc. G. S. Woolman, 116 Fulton St., N. Y.

NEW BOOKS AND PUBLICATIONS.

VAN NOSTRAND'S SCIENCE SERIES. New York: D. Van Nostrand. Price 50 cents.

Numbers 45 and 46 of these reprints are respectively: Thermodynamics, by Henry T. Eddy, C.E. Ph.D., of the University of Cincinnati; and Ice Making Machines, translated from the French of M. Ledoux, mining engineer. The former aims to give a brief and logical exposition of the fundamental and simplest applications of thermodynamics; the latter discusses theoretically the conditions of effective working of the three classes of ice-making machines.

RESUME OF YELLOW FEVER. (Quarantine and Home Sanitation.) By A. Clendinen, M.D.

Abstract of report by Dr. Clendinen, as chairman of Committee of Intelligence, District Society of Bergen County, New Jersey, first printed in the Transactions of the State Medical Society. The author has brought together a good many facts in the history of yellow fever, which he finds well described by Hippocrates, 2,240 years ago. He does not believe that the disease is always imported, and denies the efficacy of quarantine to prevent its occurrence when local conditions are favorable.

A CATECHISM OF THE MARINE STEAM ENGINE. By Emory Edwards. Illustrated. Philadelphia: Henry Carey Baird & Co. 12mo, 374 pages. Price $2.

Offered as a practical work for practical men, especially for young and inexperienced engineers, mechanics, and firemen, who wish to adopt marine engineering as a profession. For such men it is likely to prove very serviceable. They will at least find no trouble in understanding what the author has to say, his language being admirably simple, direct, and free from mathematical or scientific affectation.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) O. R. writes: Your recipe on shoe dressing is very good. I find that the different ingredients give a good black liquid, which makes the leather smooth, soft, and black, but without gloss. Can you inform me how to obtain a gloss? A. Increase the percentage of shellac and ammonia.

(2) H. C. asks how much fall would be required in a ditch to carry the water three miles an hour, provided the ditch is straight. A. The flow of water in the ditch would depend upon the character of the soil and smoothness of the surface. 2. Could you refer me to some reliable work that treats on running water and ditching, etc.? A. "Fanning on Water Supply Engineering" is a good work.

(3) "Atlas" asks how to mount maps on cloth, and best kind of paste and fabrics for purpose. A. Stretch smooth factory cloth upon a frame and coat it with glue size. Before this dries, apply a strong flour paste to the back of the map and lay it smoothly on the cloth. Let it remain until perfectly dry. If the map is to be varnished, apply two or three coats of isinglass size, and after it becomes thoroughly dry flow on a coat of varnish consisting of balsam of fir diluted to the proper consistency with turpentine.

(4) J. P. asks: 1. Can a current of electricity be generated by an electro-dynamic machine, without the use of either a battery or permanent magnets to charge the machine with? A. Yes; see SUPPLEMENT, No. 161. 2. What is the electromotive force of the Grenet battery when first connected? How long after it is put in action will it maintain its strength, and to what extent will the force of current decrease? A. 1·095 volt. The strength of the current diminishes quite rapidly if the battery is allowed to remain in action any considerable length of time continuously. It is not adapted for a continued use, but where a strong current is required occasionally for a few minutes at a time it answers a good purpose. 3. What form of battery best combines strength of current, constancy, and economy? A. Bunsen's, or some of its modifications.

(5) E. M. C. asks: Is there an easy way of distinguishing between 8vo, 12mo, 16mo, 18mo, and other sizes of books, by those not practical printers, and what is it? A. Count the pages between printers' signatures (letters or figures) at the foot of pages.

(6) O. M. S. asks: Is a lightning rod supported upon large insulators and having no ground connection, supported by any scientific authority that you know of? A. No.

(7) J. S. B. writes: The yachts in use here, of which there are many, are built on a flat model. They are very broad beam, the beam in some cases being about 2-5 of the length, and usually light draught. They are without keels, but furnished with center boards. Now, I am thinking of building a yacht, upon a deeper and narrower model, with keel. How will the two compare for speed? And how would it do to make the keel in latter model in whole or part of iron, heavy enough so that ordinarily no other ballast will be needed? My object in this is to bring the center of gravity as much below the water line as possible, as it seems to me that by so doing we would be able to sail closer to the wind without going over. Would my plan have that effect? A. The mere form of midship section does not determine the best model. What you propose would probably be fastest in deep water and strong winds, but the light draught fastest in light winds. The iron keel is good and should be heavy; do not make your cross section too full below.

(8) F. M. D. asks what is the horse power of an engine of 6½ inch cylinder, 14 inch stroke, 70 lb. pressure, 180 revolutions. I am running an engine of that size, there has been quite a dispute about it. One man said it was a four horse, another said 20. I think it about an 8 horse. A. If you are working 70 lb. pressure on the piston, whole stroke, the available power is about 24 horse power. By actual calculation it is 32 horse power; deducting 25 per cent for friction and other losses, leaves 24 horse power.

(9) "Inventor" writes: I want to connect an engine or engines to a shaft running 390 or 400 revolutions per minute; how small ought the cylinders to be to give me 8 or 9 horse power, and what size upright tubular boiler will furnish steam? Can I run the engines with success? How many engines are necessary? A. A 6 inch cylinder and 8 inch stroke will give you the power you want. A vertical tubular boiler should have at least 220 feet heating surface. To run at such high speed successfully, everything must be well proportioned and nicely fitted.

(10) J. F. asks: What is the best method of easily and economically separating in large quantities of salt water, the calcium magnesia, etc., so that the salt will remain pure? A. There are three methods employed for separating salt from calcium magnesia, etc.: *a*, by evaporation of the water by aid of the sun's heat; *b*, in winter by freezing; *c*, by artificial evaporation. The first method is generally used on the coast lines of southern Europe. The arrangement of the salines or salt gardens is as follows: On a level sea shore is constructed a large reservoir, which by a short canal communicates with the sea, care being taken to afford protection against the inroads of high tides. The depth of water in these reservoirs varies from 0·3 to 2 meters. The sea water is kept in the reservoir until the suspended matter has been deposited, and is then conveyed by a wooden channel into smaller reservoirs, from which it is conducted by underground pipes to ditches surrounding the salines, where the salt is separated from the water. The salt is collected, placed in heaps on the narrow strips of land which separate the ditches from each other, and sheltered. As these heaps are left for some time, the deliquescent chlorides of magnesium and calcium are absorbed in the soil, consequently the salt is comparatively pure. If the salt water is derived from salt wells or springs, the brine is immediately boiled down. This boiling generally requires several weeks, the scum being removed and the soda and calcium sulphates deposited removed with perforated ladles. As soon as a crust of salt is formed on the surface of the liquid a temperature of 50° C. is maintained. At this stage the salt is gradually deposited at the bottom of the pan in small crystals, and being removed, is put into conical willow baskets, which are hung on a wooden support over the pan to admit of the mother liquor (which contains the greater part of the magnesium and calcium chlorides) being returned to it. Finally, the salt is dried and packed in casks.

(11) G. S. T. writes: A reservoir is 60 rods distant, descent 40 feet. One pipe of 1¼ inch bore contracted to ¾ inch just at the lower nozzle, the other pipe of 1½ inch bore for 20 rods, 1 inch bore for the next 20, and the last 20 rods of ¾ bore. Which of the above will convey more water? A. In a 1½ inch pipe contracted just at the outlet the friction will be least.

(12) T. M. J. asks: 1. Will the water, if conveyed to the boiler in a 2 inch pipe, force itself into the boiler against a greater steam pressure than (say) in a ½ inch pipe? A. No. 2. In "Peck's Natural Philosophy" there is an illustration of how a cask was bursted, by filling the cask with water from the top of a tube 34 feet long. Will the heavier weight of water in a large pipe not add materially to pressure per square inch at the lower end of the pipe? A. No. 3. Could I overcome any resistance in the boiler by letting the water into the boiler through a funnel or a small hole on the principle of an injector? A. You cannot, unless you use an injector.

(13) J. R. H. asks: 1. Can exhausted steam be used to heat up a workshop? A. Yes. 2. In what way does it affect the working of an engine? A. Produces a little back pressure on the piston. 3. And what per cent of power is lost between exhausting through a pipe 20 feet long, and one 120 feet long? A. Difference is not appreciable if pipe is large.

(14) G. E. T.—You will find directions for making batteries in SUPPLEMENTS, Nos. 157, 158, and 159.

(15) W. H. B. asks, Does the microphone strictly magnify the sound or only transmit it? A. It merely transmits it.

(16) C. K. M. asks: 1. What is the best method of magnetizing a rat tail file 15x¼? A. Inclose the file in a helix made of about 50 feet of No. 16 insulated wire, and connect the helix with 4 or 6 cells of carbon battery. 2. Can I magnetize it with an ordinary Daniells battery, by wrapping it with insulated copper wire? A. Yes, by using 6 or 8 cells.

(17) S. G McM. asks: 1. Will a etlephone that is constructed as described in SUPPLEMENT, No. 142, work when the coil is made of No. 30 wire? If not, will it with No. 32? A. No. 30 wire is too coarse. No. 32 might answer, but the results would not be satisfactory. Use No. 36. 2. What size should the connecting wire be if made of copper? A. No. 18 will do.

(18) A. S. B. asks: How can I take grease out of marble? A. Mix sal-soda with two parts of quicklime in powder, moisten the mixture with soft cold water, coat the marble with this, and let it remain twelve hours. Then wash with water and a little soap if necessary.

(19) J. D. asks: How can I make an alloy of copper which will attach itself to glass, metal, or porcelain? A. 20 to 30 parts finely blended copper (made by reduction of oxide of copper with hydrogen or precipitation from solution of its sulphate with zinc) are made into a paste with oil of vitriol. To this add 70 parts of mercury and triturate well; then wash out the acid with boiling water and allow the compound to cool. In ten or twelve hours it becomes sufficiently hard to receive a brilliant polish and to scratch the surface of tin or gold. When heated it becomes plastic, but does not contract on cooling.

(20) A. L. C. asks why a piece of paper cannot be blown off the end of a tube if it is simply placed over the tube at one end with nothing to fasten it. A. This phenomenon occurs only when the tube has a flange or its equivalent around the discharge opening. The adherence of the paper to the end of the tube is due to a vacuum formed on the surface of the card by the lateral discharge of air. This subject is fully treated in an article on the ball puzzle in SUPPLEMENT, No. 51.

(21) A. H. asks: Where on the globe will the new year 1880 be greeted or welcomed first? A. In New Zealand most probably; possibly a little earlier at some English missionary station in Polynesia. Eastern Siberia is ruled out of the reckoning by the Russian calendar; and our Alaskan islands by their taking their time from San Francisco.

(22) L. P. B. writes: I wish to know what gives the kind of ink used with the hectograph the peculiar bronze luster? A. The ink consists of a strong solution of aniline violet, which crystallizes on the paper in drying.

(23) W. C. B. asks what will remove iodine from marble. A. Try strong aqua ammonia.

(24) A. B.—Laboulbène recommends for the preservation of insects in a fresh state plunging them in a preservative fluid consisting of alcohol with an excess of arsenious acid in fragments; 1½ pint alcohol will take about 14 troy grains of arsenic. The living insect, put into this preparation, absorbs about 3-1000 of its own weight. When soaked in this liquor and dried, it will be safe from the ravages of moths, *Anthrenus* or *Dermestes*. This liquid will not change the colors of blue, green or red beetles if dried after soaking from twelve to twenty-four hours. *Hemiptera* and *Orthoptera* can be treated in the same way. The nests, cocoons, and chrysalids of insects may be preserved from injury from other insects by being soaked in the arseniated alcohol, or dipped into benzine or a solution of carbolic acid or creosote.

(25) W. H. M. asks (1) whether methyl chloride is an article of commerce and whether it is expensive. A. No; it is a colorless gas at ordinary temperatures and pressure; it is condensable to a liquid at minus 21° C. To keep it in the liquid form it must be stored in very strong and hermetically sealed vessels. 2. Would it be necessary to produce pressure with the article, before evaporating, to produce a low temperature? If so, how much; if not, how low might the temperature be reduced by the use of an air pump to produce a vacuum and beginning at normal temperature and pressure? A. Exposed to the air it (the liquid) evaporates with great rapidity, its temperature falling below 0° F.; in vacuo this evaporation of course proceeds more rapidly than in air, and hence the reduction of temperature is greater. The greater the amount of liquid evaporated in a given time the lower the temperature attainable. 3. How large a quantity of methyl chloride should be used to produce appreciable results? A. Six ounces.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. W.—The substances you send for examination are as follows: 1. Red sandstone. 2. Calcite. 3. Hedenbergite. 4. Artificial. 5. Red granite. 6. Graphite in calcite. 7. Epidote. 8. Satin spar in dolomite. 9. Coccolite. 10. Dolomite. 11. Quartzite. 12. Hornblende. 13. Clinochlore. 14. Chlorite. 15. Natrolite. 16. Spodumene. 17. Calcite. 18. Iceland spar. 19. Limonite. 20. Decomposing feldspar.—O. E. C.—The sample is an impure Berlin blue containing alumina (from the alum used in its manufacture).—N. C.—The rock consists of serpentine, hornblende and quartz with copper and iron sulphurets (chalcopyrite and pyrite).—E. E.—The rock is a talcose slate. Some of it would doubtless answer very well for furnace linings if it can be worked economically.—H. S.—Amygdaloid trap, semi-decomposed—it contains opal quartz.—R. G. V.—No. 1 is rutile—titanic acid—oxygen 39, titanium 61—100. No. 2. Titaniferous sand, menneconite. No. 3. Ferruginous quartz containing crystals of rutile and iron pyrites, also probably gold.—W. K.—The quartz contains nothing of value.—G. W. K.—It is clear quartz rock. Useful for glass making.—O. B.—The iron ore is hematite of excellent quality.—J. C. M.—No. 1. Gypsum, lime sulphate. No. 2. Calcite, lime carbonate. No. 3. Malachite and azurite, carries traces of silver. No. 4 Contains clay, sand, and lime phosphate.—J. M. F.—It is the *mutilla occidentalis*, quite common in the Southern States.

COMMUNICATIONS RECEIVED.

On Ice Yachts. By J. E. K.
On Improvements in Telephones. By T. L. W.
On Measuring the Uneclipsed Portion of the Sun's Diameter. By L. L.
On a Curious Bone Formation. By E. L. W.
On the Great Wheat Belt of the United States. By J. W. B.
On Patent Temperance Reform. By L. J. F.
On New Motive Power. By W. M. M.
A Theory of the Tides. By W. B., Jr.
On Sailing Ice Boats. By H. R. B.
On Paraffine in Oil Wells. By D. F.
On the Velocity of Ice Boats. By P. F. S.
On Small Steamers. By J. A. W.
The Law of Dust Explosions. By A. D.
On the Speed of Ice Boats. By T. S. S.
On Making Copying Ink. By C. F. L.
On Explosion of Dynamite. By N. R.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

November 4, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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