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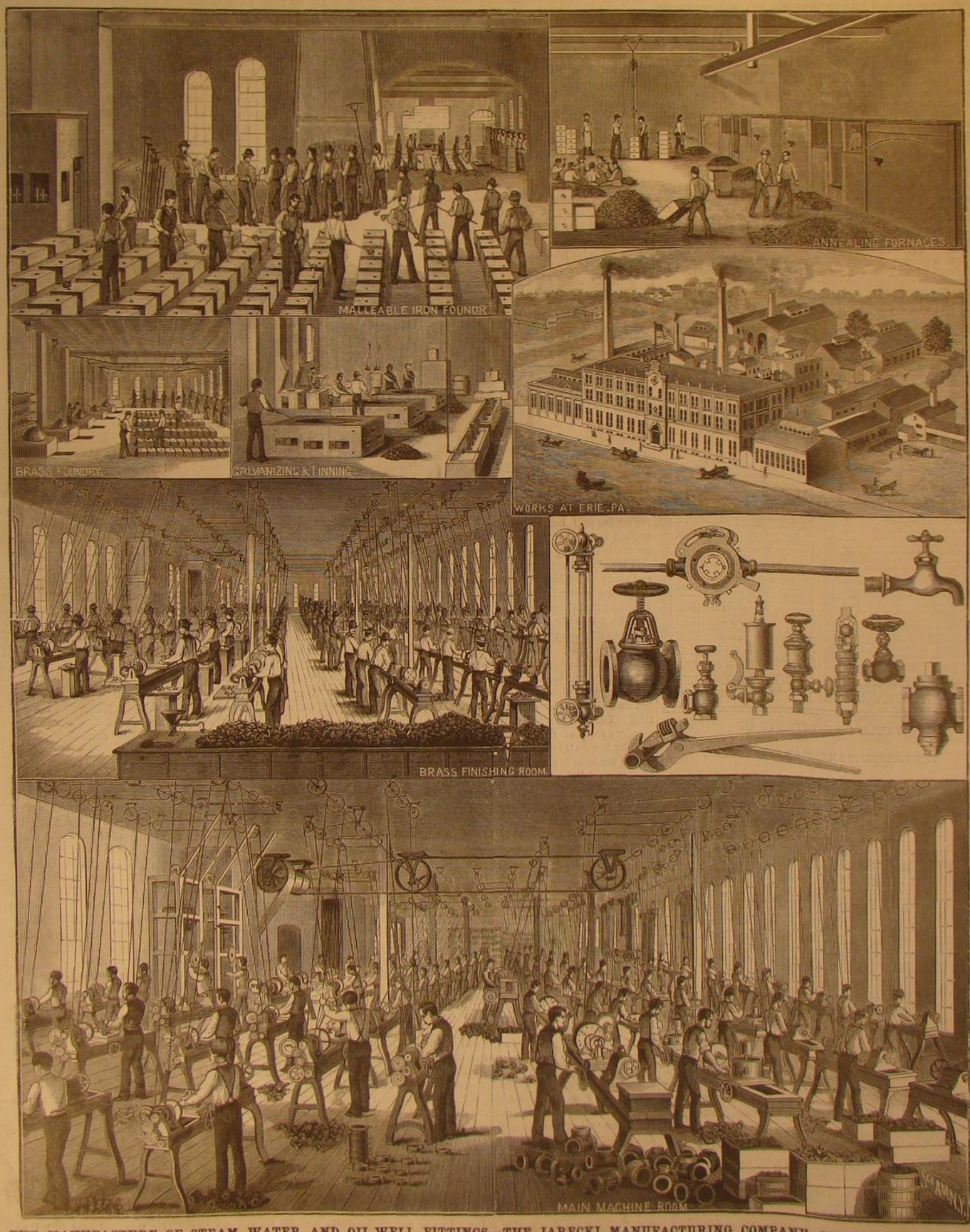

THE MANUFACTURE OF STEAM, WATER AND OIL-WELL FITTINGS.—THE JARECKI MANUFACTURING COMPANY ERIE PA.—[See page 264.]

Scientific American.

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AMERICAN ART IN TOOLS.

The SCIENTIFIC AMERICAN has had frequent occasion to commend the artistic construction of American tools and machines, and has unsparingly condemned the lofty disdain with which the self-constituted artists—in reality mere picture makers and copyists for the most part—have looked down upon everything mechanical as of necessity inartistic. The great truth that genuine art effects have always and in all countries resulted from work in which the art element has been held subordinate to utility, has been too largely overlooked in the art schools; and while the would-be artists have accomplished little and added less to the world's stock of artistic forms and ideas, the despised artisans have developed—in the one field in which their work has not been misguided by conventionally artistic designers—results which command the admiration even of artists and art critics. This simply because their chief aim has been to make not "artistic" machines and tools, but such as should be best adapted to perform the work required of them, with the least outlay of material and working force, not disregarding shapeliness and harmony of proportion.

Unexpected confirmation of the correctness of our position, heterodox as it may have seemed, appears in a communication from Florence, Italy, to the New York *Times*. The writer, Mr. J. J. Jarves, has been studying some illustrated trade circulars which American merchants have sent to that market. As an art critic he finds in them new ideas regarding American art.

After reviewing rather caustically and at considerable length the failure of American artists and architects to do much more than to copy in a fragmentary and inartistic way the styles, designs, and decorative ideas of other races and ages, with no central creative principle as a guide, Mr. Jarves says:

"The finest art yet developed in America, one in which my countrymen excel all other peoples, is in a direction which they themselves have never recognized or suspected. They have perfected it in its department simply because they have been governed by sound principles joined to a keen consciousness of lines and forms, wedding sharpest practical use to completest beauty of its kind by unconscious pursuit of perfection—in a very limited direction, it is true, but one which forms the starting point for all others, highest art inclusive. I refer to our tools—the axes, hatchets, spades, shovels, hammers, and other metal weapons, by which we hew, plant, and conquer our virgin soil and tame it to our needs. So shapely are they, so nice their gradations of lines, so thoroughly adapted to their ends, graceful, light, and strong, bright and cheery to look at, honest of purpose, sincerely made, that there is in them a touch of the æsthetic as well as the sense of the artistic, unmistakable as the repose and beauty of Greek art. Their makers have worked better than they knew, and nature has led them into art while thinking only of use."

If Mr. Jarves could go into many of our machine shops and study as intelligently the construction and admirable adaptation of our larger and more complicated machines, he would find them as worthy of admiration as the simpler tools he so justly commends. In the designing and construction of these the conventionally misinstructed "artist" has had no hand. The mischievous though unrecognized work of this class of designers is seen by Mr. Jarves, when he compares our tools with more ambitious products—furniture, organs, pianos, etc.—good in themselves practically, but made hideous by abortive attempts to make them beautiful. These—the work of professional designers—tell, he says, "a story of defective æsthetic training, and what deformity is sure to result from attempts at ornamentation before the taste is sufficiently trained to distinguish artistic truth from falsehood. If the makers of these things would simply try to perfect them, keeping their objective aims strictly in view, following the example of the tool makers—and I can include in some degree makers of wooden ware—they would produce far more artistic work in the end than they are now doing with all their eagerness to recommend their wares by labored, overdone decoration. Theirs is the slang of ornament, as ungrammatical and false as pigeon Chinese or backwoods speech, and tenfold more unnatural. We cannot make any substantial progress in industrial art until this whole haphazard system of decoration is thrown away, and we begin anew at the right end, *i. e.* learn the simple alphabet of art before trying to make eloquent speeches in its language. Years ago, when the material interests of the nation, and its heart, also, went oceanward in seeking to build the fastest ships, our builders, following the hints of nature and keeping their own aims steadily in view, succeeded in producing the most beautiful vessels possible; perfections of marine architecture, complete works of art, the like of which the world seems destined never again to witness. This was the result of knowing what they wanted, and, perseveringly studying means to ends, perfecting the ships as to character, and consequently as to comeliness; for even in material things the spiritual holds sway and begets beauty from truth of form. I honor these American tool makers as serious pioneers of American art, unwittingly though it may be to themselves. Theirs is the correct principle and right path of labor and progress."

There is a popular cry just now, and a just one, for a multiplication of schools of decorative art, schools in which our young artisans shall be trained to be artists also in their respective callings. In the right hands such schools may be and must be of inestimable value. In the wrong hands they cannot fail to be mischievous. If their motive is "art for its own sake," they may succeed in teaching our artisans to make pretty imitations of antiques and such like, but nothing better. At the worst they may do much to turn our workmen from "the correct principle and right path of labor and progress." The art which has sprung up in our machine shops from sincerity of purpose and a practical sense of economy and fitness, looking first to utility and then to beauty, is the art which the new schools should encourage and cultivate.

A TEA CULTIVATOR WANTED.

The manager of a large tea farm in India appeals, through the SCIENTIFIC AMERICAN, to American inventors for what we may call a spading machine, to be used in the cultivation of tea plants; the machine to be worked either by bullock or steam power.

The tea bushes on the estate in our correspondent's care are mostly planted four feet by four feet apart, in plots eighty plants broad by four hundred and twenty plants long; a few acres are planted four feet by five feet and dve feet by five feet, in fields of the same length and breadth. Many tea gardens, however, are planted five feet by five feet. The tea bush grows from three to four feet high; it occupies about a square foot of ground at bottom, and at top spreads so that the lines of bushes almost (sometimes quite) touch each other. The nearest approach in America to a tea field, our correspondent thinks, is a plot of gooseberry bushes, which somewhat resemble the tea bushes, minus the thorns. In general aspect an ordinary cotton field might be compared, we imagine, to a tea field; and possibly a machine suited for the cultivation of the one might be readily adapted for use in the other.

The India tea fields are dug by hand from twelve to fifteen inches deep, the upper surface, grass, etc., being turned over and buried and the subsoil brought up to the top. A day's work for a cooly is to dig one line across a field, or 1,280 square feet. The ordinary plow will not answer for this work, as it leaves one side of the bushes uncultivated and cuts the roots of the bushes on the other. The horse hoe or cultivator has been tried, but it does not cut deep enough, it does not turn the soil over, and it injures the outer stems of the bushes.

What is required is a machine working a blade or blades set at right angles to the handle, with an up and down motion, and so operated as to turn the soil over. It must dig to a depth of fifteen inches and turn the soil thoroughly. It must dig close to the root of the plant, yet not injure the side stems; and it must be able to do much more work than a cooly can do—say ten or twenty times as much, when drawn by a bullock or by a fixed steam engine working with wire ropes. A machine of this character, able to compete successfully with cooly labor, both in cheapness and efficiency, would bring, our correspondent thinks, a small fortune to the inventor, "as there are upward of a thousand tea gardens in India hard up for coolies and looking out for something of this kind."

We may add that the inventor's right may be protected in India by patents. Also that the extension of tea culture in Java, Formosa, and other islands, not to mention Japan or China, would seem to offer a wide field for the introduction and sale of a successful cultivator. The same machine might also, as already suggested, be adapted to the requirements of cotton and other fiber plants.

Our correspondent's address is R. B. Macnaughton, East Hopetown Estate, Dehra Doon, British India.

The Work of the Patent Office.

The Commissioner of Patents has forwarded to the Secretary of the Interior his report of the operations of the Patent Office for the past fiscal year, and his estimate of the amount necessary during the next fiscal year. The number of original patents issued during the first nine months of the present year was 13,084, an increase of 2,261 over last year. The receipts of the office for the same period were $65,447 in excess of those for the corresponding nine months of 1880. The report recommends a considerable increase in the examining corps and the clerical force of the office, and the following appropriations: $50,000 to carry out the abridgment of patents and the publication of 10,000 volumes of the same; $15,000 for reproducing burned and exhausted drawings; $10,000 for photo-lithographing drawings; and $9,000 to complete the *Official Gazette* for the present year.

American Society of Microscopists.

At the fourth annual meeting of this society, held at Columbus, Ohio, August 9, 10, and 11, 1881, the following officers were elected for the ensuing year, namely: President—Dr. George E. Blackham, Dunkirk, N. Y.; Vice-Presidents—Dr. Lester Curtis, Chicago, Ill., and Dr. Thad. S. Up De Graff, Elmira, N. Y.; Secretary, for three years—Prof. D. S. Kellicott, 119 Fourteenth street, Buffalo, N. Y.; Treasurer for three years—Geo. E. Fell, C. E., 162 Prospect avenue, Buffalo, N. Y.; Executive Committee—E. H. Griffith, A.M., Fairport, N. Y.; Dr. Robert Dayton, Cleveland, Ohio; Prof. Albert McCalla, Fairfield, Iowa. The next meeting will be at Elmira, N. Y., in August, 1882.

NEW METHOD OF ASSASSINATION.—A merchant of Santanda, Central America, was lately murdered by a new and ingenious use of dynamite. The charge was placed in the large lock of his store door, with the exploder arranged to be set off by the door key. He was instantly killed on attempting to unlock the door.

STEAM BOILER NOTES.

The coroner's jury in the case of the Bullman & Brown boiler explosion in Jersey City, N. J., which occurred on the 13th of September, rendered, October 6, the following verdict:

"That the effective cause of the explosion, on the morning of September 13, 1881, of the boiler on the drydock of Bullman & Brown, located at the foot of Essex street, Jersey City, causing the death of Lionel D. Decker, was from an imperfect safety valve in the hands of a careless, incompetent engineer, in the person of George Everson; and we further censure Messrs. Bullman & Brown for leaving the boiler without an engineer from 7 to 8 o'clock in the morning; and we would recommend that the Legislature of this State enact some law requiring the licensing of engineers and the inspection of all boilers once a year."

Whatever else may be said of the phraseology of this document, it certainly cannot be called ambiguous or equivocal.

In pursuance of this verdict, Joel W. Brown and Adam Bullman, the drydock firm, were arrested and held in $2,000 bail each, to await the action of the Grand Jury in the matter of the killing of Lionel D. Decker, by the explosion of the boiler. Each defendant was compelled to furnish two bondsmen. George Everson, who was in charge of the boiler, was also arrested, and his late employers became his bondsmen in the sum of $2,000. Bullman & Brown, it is said, have paid Capt. Decker's widow $3,500 in settlement for the loss of her husband.

This explosion was fully reported, with illustrations, in the SCIENTIFIC AMERICAN of October 1. The case was so plain that no other conclusion could have been reached by practical men who took the trouble to look for themselves at the corroded safety valve.

The safety valve having been tested by direction of the coroner while in the corroded state in which it was picked up after the explosion, it was found that 2,000 pounds, equal to about 450 pounds to the square inch, did not move it from its seat. The iron stem of the brass valve was perfectly cemented in the hole in the iron bonnet, in which it was intended to slide freely, by corrosion. It was forced out partly by the application of about 4,000 pounds, and completely by driving with a hammer. It was then cleaned and adjusted for another test, which showed that the valve would have blown off when in order with the weight at the point on the lever where it was found firmly fixed by a set screw, at between 50 and 60 pounds per square inch, and with the weight at the extremity of the lever it would, when in order have blown off at 100 pounds per square inch. This boiler was used only at intervals, and with the appearance indicating that the valve had been leaky, the conditions could scarcely have been arranged better for the promotion of results.

On the morning of the explosion the young man who generally built the fire for the usual attendant, then absent, found the fire low, and thinking the engine would soon be wanted to pump the dry dock, put coal in the furnace, closed the furnace door, and went away to other duty. At the end of about three-quarters of an hour steam began to issue from the seams, all steam outlets being closed, and increased to such an extent that the boiler could not be approached by the terrified dock hands for the purpose of opening the furnace door, although pike poles were used for the purpose. It is said that it blew up while the temporary attendant was still at work with his pike pole at the furnace door. He was blown into the water and badly injured. The verdict appears to be severe on the owners, since they thought that their man had been long enough acting as engineer to know something about the duties required, while there was no means provided for testing his knowledge or the soundness of his judgment of the reliability of the most important safety device about a steam boiler. There is still another party, the one who put an iron stem through an iron valve bonnet, that ought, perhaps more than any other, to be indicted for manslaughter in this case. If the coroner had hunted up and brought him or them to taste Jersey justice he would have been entitled to the "cake" as a model coroner in boiler explosions. Notwithstanding the testimony of the valve itself, more than one human witness testified that this valve would blow off at seventy-five pounds, and had done so within a few days before the explosion. The valve was perhaps leaky at that pressure, but it is not at all probable that it would automatically relieve the boiler as it ought, or so that whatever the fire might be steam could not rise to a dangerous pressure.

The boiler in Landue & Plinney's car factory at Carrollton, Mich., exploded October 2. Two brothers, named John and James Picard, were killed, and damage was done to the extent of $7,000.

On October 4, one of the boilers at B. S. Nichol's machine shop in Burlington, Vt., exploded, demolishing the two story brick building in which it was placed. No one was injured, though the engineer and fireman were in the room at the time. The loss will be several thousand dollars. The cause of the explosion is not known.

Compound Steam Engines.

Hallauer's recent experiments have led him to the conclusion that the difference between engines of one and two cylinders, in point of economy, is very slight. In ranging from 80 to 8,000 horse power, with revolutions varying from 25 to 90 per minute, the expenditure of steam for a given amount of work remains the same for the same type of motor; the consumption for two cylinder motors are identical for Woolf and compound, whatever may be the volumes of the cylinders, provided the motors are regulated so as to give the maximum efficiency; the expenditures of steam in motors of one, two, and three cylinders, suitably regulated and constructed, are so nearly alike that the choice may be governed in each instance merely by the fitness of the type of the engine for the particular purpose desired.

MICA.

As in times past, when the search after the "philosopher's stone" resulted in the discovery of many unsought, but nevertheless valuable substances, it frequently happens that the treasure seeker of to-day brings to light some unthought of ore or mineral—not as valuable as the substance sought, but certainly well worth finding—if the discoverer is wise enough to understand this.

The discovery of good merchantable mica in some of our Western gold mining regions is illustrative of this We have recently received many samples of this peculiar mineral—chiefly from Dakota, Colorado, and California—and some of these compare very favorably with the best products of the celebrated Carolina mines. We are glad to note this, for mica is peculiarly well suited for hundreds of useful applications in the arts for which it is not now available on account of its cost.

Mica is a very common mineral in some localities, but the merchantable article is by no means common, and a large body of "mica rock," capable of affording large, clear, and colorless sheets of the mineral, free from flaws and of uniform structure, is worth developing almost anywhere.

Muscovite or oblique mica—the clear variety—is essentially a silicate of aluminum and potassium. When the crystallization is uniform it can be easily separated with a knife blade into very regular flexible and elastic sheets of almost any required thickness. It is not affected by water or strong acids (with the exception of hydrofluoric acid), and may be heated quickly to redness without danger of melting or cracking it. In thin plates or sheets it resembles glass, but it is not brittle, and this, in connection with the other peculiar properties alluded to, make it available and serviceable as a substitute for glass under conditions which preclude the use of the latter. Mica is never quite colorless, although in good samples the color is barely perceptible in the thin sheets. That having a faint wine or brandy tint commands the best prices.

In the New York market the mineral is usually sold by the pound, in sheets cut to sizes varying from two inches to fifteen inches square, the price varying with the size and number of sheets to the pound, color, and quality. When the sheets are properly split, trimmed, and cut to size the prices for good clear mica vary from twenty cents to eight dollars per pound.

Of the numberless uses to which this mineral glass has been put it is chiefly in demand for the glazing of stone and furnace or heater doors, and as a substitute for glass in some kinds of lanterns, as it is much lighter and tougher than glass, and is not easily ruptured by jar or concussion. The latter consideration has caused its substitution for glass lights on gunboats and naval vessels.

Mica is peculiarly well suited to the construction of light roofs and walls for galleries, conservatories, greenhouses, or hotbeds, etc., as it can be easily shaped and bent, and secured with tacks after the manner of shingles; is not easily fractured, and requires very light supports. We have seen structures of this kind, and they would seem to leave little to desire in this line, except, perhaps, larger sheets of the mineral and a reduction in its cost. The sheets may be tinted or colored by dipping them momentarily in a very dilute alcoholic solution of pale shellac suitably colored with any of the soluble coal tar or aniline dyes, and exposing them for a few minutes to warm air to dry. Very pretty color effects can thus be produced. A simple way of producing a frosted or ground appearance on the sheets of mica is to coat them with a thin milky varnish prepared by mixing together solutions of one ounce of pale shellac in three pints of wine spirit and one ounce of pale resin in a pint of good benzine. A rather thin sirupy solution of water glass, with which has been mixed a trace of zinc sulphate dissolved in water, can be used in a similar manner to effect this object.

A colorless cement for joining sheets of mica is prepared as follows: Clear gelatine is softened by soaking it in a little cold water, and the excess of water is pressed out by gently squeezing it in a cloth. It is then heated over a water bath until it begins to melt, and just enough hot proof spirit (not an excess) stirred in to make it fluid. To each pint of this solution is gradually added, while stirring, one-quarter ounce of gum ammoniac and one and one-third ounces of gum mastic previously dissolved in four ounces of rectified spirit. It must be warmed to liquefy it for use and kept in stoppered bottles when not required. This cement, when properly prepared, resists cold water.

Flexible mirrors are made from sheet mica, the silver being deposited from a solution of the nitrate by one of the processes described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 105. Small mirrors of this description are used in some kinds of inlaid work and for various decorative purposes. As their flexibility admits of their application to irregular surfaces they can be used where glass mirrors cannot. With the aid of a little gold leaf, bronze powders, size, and variously colored thin transparent varnishes or collodion mica has been worked into hundreds of beautiful articles for decorative purposes, toys, etc.

When mica is heated to redness for some time in a muffle and then allowed to cool rather quickly the laminæ become distorted and the sheets present a silvery-white appearance by reflected light, the mineral losing much of its flexibility. The dust of this whitened mica is used to some extent by the French as a silver bronze powder. Mixed with a weak solution of gum arabic it makes a good silver ink. The powder is sometimes variously tinted by washes of very dilute colored solutions of gums or varnishes. To prepare the glistening powder the sheets of whitened mica are simply crushed (not ground), boiled in hydrochloric acid, rinsed, dried, and assorted to size of laminæ. The finer filaments have a pearly luster and are made to adhere to semi-softened gelatine and wax to imitate pearl. The silvery powder is used on metals, glass, wood, paper, plaster, tapestry and furniture. It has also been used in calico printing in place of the heavy bronze and glass dust of Lyons fabrics, and for the decoration of china and glassware.

Mica is used by electricians for certain insulating purposes and also to some extent by makers of philosophical and optical instruments. Good mica, because of its lightness, is often employed as a substitute for glass in spectacles designed to simply shade the eyes or to protect them from dust, cinders, or flying particles of metal or stone for travelers, millwrights, grinders, polishers, and others whose work necessitates such protection. Vessels of mica are often used in the chemical lecture room, and are particularly serviceable in the experimental illustration of the properties of certain gases—the burning of metals in oxygen, etc.

The powdered or crushed mineral has recently been used, in connection with nitroglycerine, in the preparation of a kind of dynamite called mica blasting powder. It has also been employed as a filling for fireproof safes, as a non-conducting covering for boilers and steam pipes, and, in connection with water glass, as a fireproof varnish or paint. The larger sheets, applied after the manner of shingles, make a very good fireproof roofing material.

Formerly most of the merchantable micas used in this country was imported, but for the past few years—since 1867—our supply of the mineral has been derived chiefly from mines located in Mitchell, Heywood, Yancey, McDowell, and Macon counties, North Carolina. The product of these mines is at present hardly equal to the demand, which is increasing very rapidly.

The discovery—or rather rediscovery (for some of them show signs of having been worked centuries ago)—of these valuable beds of mica in the Carolina gold fields was, like the Western "finds" above referred to, one of the results of a search after the precious metals.

The Atlanta Exposition.

The International Cotton Exposition at Atlanta, Georgia, was formally opened October 5. Among the thousands of visitors present were many representatives of the North and West. The assemblage was called to order by Governor Colquitt. After prayer by Bishop Elliott, of Texas, the buildings and grounds were presented to the Exposition Association by Director General Kimball. In responding Governor Colquitt highly complimented the executive committee and expressed the belief that the energy bestowed in the development of the enterprise thus far had never been exceeded. All the space in the several large buildings has been taken, but a fortnight must elapse before all the exhibits can be in place and in presentable condition. After the machinery was started Senator Vance, of North Carolina, delivered an address of welcome on behalf of the Southern people. Senator Voorhees, of Indiana, followed with an oration in which he took strong grounds in favor of the development of Southern industry through the fostering influence of a protective tariff. "Free trade," said he, "is a seductive sound that can mean nothing except where it is purely reciprocal, and exists between nations of equal strength. It is the duty of the government to protect its own industries before it practices benevolence."

This is the first world's fair ever held in the South, and while it properly takes its name from the leading Southern product its scope includes all the material interests of the Southern States. The two hundred and twenty-two classes of exhibits are distributed in forty-one groups arranged in six departments, the first four of which are for competitive exhibition and awards, the other two for exhibition only. These departments are: I. Productive machinery, implements, processes, etc. II. Natural products, especially textile products. III. Manufacturing machinery, chiefly textile, etc. IV. Manufactures. V. Miscellaneous natural products. VI. Non-textile machinery and manufactures, art products, etc.

The site of the fair is Oglethorpe Park, which covers fifty acres, just outside the city. The buildings cover more than twenty acres, the number of exhibits having vastly exceeded anything at first contemplated The exhibits pertaining to cotton, its cultivation, handling, and manufacture, are beyond comparison superior to anything ever seen before. The wealth of general exhibits is not less a surprise to all. Particularly rich is the show of minerals, woods, and other natural products of the South. The Executive Committee announce the following special weekly exhibitions:

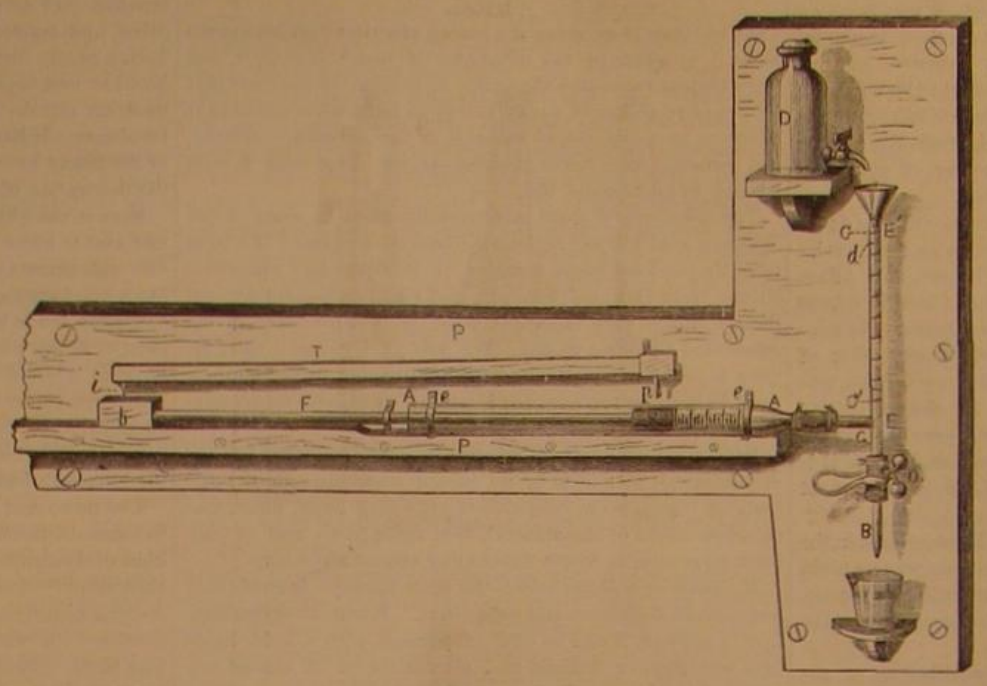
Fruits and flowers, commencing October 25; cattle and mules, commencing November 1; sheep and swine, commencing November 8; bench show of dogs, commencing November 15; poultry, etc., commencing November 22; dairy products, commencing November 29.

October 27 is set down for "Governors' Day," it being expected that the State Governors in attendance at the Yorktown Centennial Celebration will that day visit the Exposition accompanied by their several staffs.

NEW GRADUATING APPARATUS.

This apparatus was designed to facilitate the accurate graduation of glass tubes—burettes used in volumetric analyses, technical assays, pharmaceutical work, etc.

The tube, A A', to be graduated is secured by brass clamps, *e e*, to the wooden frame, P. The piston, S, of brass, loosely packed with rubber, is rigidly connected by the brass rod, F, with the block, *b*. The smaller end of the glass tube, A', is tightly connected by a piece of rubber tubing with the glass tube, G, which joins, at right angles, the small upright graduated glass tube, E E'. This tube is continued downward, and connected by a short piece of rubber tubing with the feathered delivery tube, B, a pinch cock serving to stop the tube at O. The upper part of the tube, from *c* to *c'*, is graduated to contain one cubic centimeter of water, and this space is subdivided into tenths of a centimeter. Water from D is introduced into the tube through the small funnel. The hard-wood rod, T, has a fine steel point rigidly affixed at *i*, the other end being similarly fitted with a wedge-shaped blade, *p*.



NEW GRADUATING APPARATUS.

In using the apparatus the tube to be graduated is uniformly coated with a thin film of white wax or collodion. A small quantity of water is then put into it, the piston adjusted so as to fit snugly but loosely, and the tube securely clamped in position, connection having been made with the tube, G, the pinch cock at O is opened, and the piston forced up to the end, A', of the tube, expelling the water (and air) through G and B. The pinch cock is then closed and water (at 60° Fah., or 16° C.) let into the tube, E, from D, until it is filled to the mark, C, any excess being drawn off through B.

The block, *b*, is then grasped and slowly drawn back until the water in E E' has fallen to *a*, the first mark on the scale. The steel point, *i*, on the rod, T, is then inserted in a fine hole, nick, or cut line on the upper side of the block, *b*, and held in position, while the blade, *p*, at the other end of the rod is brought down on the coated tube, and a fine line cut through the coating to the surface of the glass. The block, *b*, is again drawn back until the water in E E' falls to the next line on the scale, when the rod is brought into requisition, as before, and another mark made on the tube, These operations are repeated until the water in the tube, E E', falls to C', when it is again filled to C, from the reservoir, D, and so on, until the graduation of the tube, A A', is completed.

The lines are etched in by exposing the tube to gaseous hydrofluoric acid—evolved from a mixture of powdered fluorspar and warm oil of vitriol contained in a suitable leaden dish or by the use of liquid hydrofluoric acid. Wherever the film of wax or collodion has been cut so as to admit of contact between the acid and glass, the glass becomes sufficiently etched in a few minutes.

The wax may be removed from the glass by washing with benzine, the collodion by hot water and a brush.

Tubes graduated in this way are much more accurate than those graduated by the usual methods, or where variations in internal diameter of the tube are not taken into consideration. The time required in the operation is reduced nearly one half over the older methods of volumetric graduation.

Statue of Marco Polo in Venice.

A statue of Marco Polo, discovered in Canton, has been received at his native city, Venice. It is life-size, made of wood, and gilt. According to a foreign contemporary, the famous Venetian traveler is represented seated, wearing the Chinese attire, although the cloak and hat are after the European fashion. His moustache and beard, which surround his face, are tinged dark blue, and while the Chinese artist has given him a peculiar form, the features in no way resemble those of a Mongolian type. Opposite the large, red, easy armchair upon which Marco Polo is seated is placed a porcelain bowl, intended to receive perfumes, with which he was honored in the same manner as is the protecting genius of China in the temple of Canton. The statue has, at the foot, an inscription in Chinese characters.—*Builder.*

The Faure Battery and the Electric Light.

Some experiments of considerable importance have lately been carried out by Mr. Keates, the Consulting Chemist to the Metropolitan Board of Works, in which a Faure accumulator has been employed in the production of the electric light. The lamps used on this occasion were respectively those of Maxim and Swan, one of each description being attached at a time. M. Faure states that in these experiments 40 cells represent about half an available horse power for three hours. The Maxim light being placed in connection with the accumulator, 30 cells were found to give the light of 16 candles. With the same number of cells the Swan lamp gave the light of 22·4 candles; with 35 cells the lights became respectively 45·3 candles and 67·6. With 40 cells the Maxim light rose to 101 candles, and the Swan to 141. Thus far the Swan light gave the greatest amount of candle power. But with 45 cells the Maxim light rose to 229 candles, while the Swan only displayed 204. The capacity of the latter was evidently being overtaxed, for in about a minute the carbon loop broke. A power of 50 cells was then connected with the Maxim light, which then rose to 333 candles, but in about a minute the carbon loop shared the same fate as the Swan. The experiments are also interesting as showing the great increase of light obtained by a comparatively small increment of power. Thus, in the case of the Maxim lamp, taking 30 cells as the standard, an increase of one-sixth nearly trebled the light; an increase of two-sixths augmented the light more than six times; three-sixths increased it fourteen times, and four-sixths twenty-one times.

IMPROVEMENT IN TABLES.

The engraving represents a simple and inexpensive device for uniting the rails of tables and the legs with the rails to facilitate the "knocking down" and putting together of the table. The invention is a corner or angle plate provided with vertical wing sockets for the reception of the ends of opposite rails, and with inner central socket for receiving the upper end of the table leg. Fig. 1 in the engraving shows a complete extension table having the improved corners attached. It also shows the inside and outside of the corner piece in detail. Figure 2 shows the table "knocked down" and ready for shipment, and Fig. 3 is an enlarged view of the angle plate. The table corner is a casting having an outer corner or angle plate that fits against the outside of the table rails. To the inner angle of the plate, and forming an integral part of it, is attached a socket having opposite projecting side wings to fit against the inside of the table rails; these wings completing the sockets for receiving the ends of the table rails.

Fig. 3

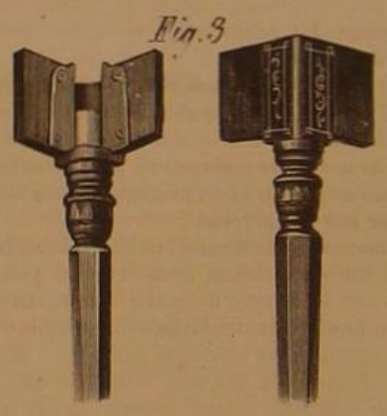
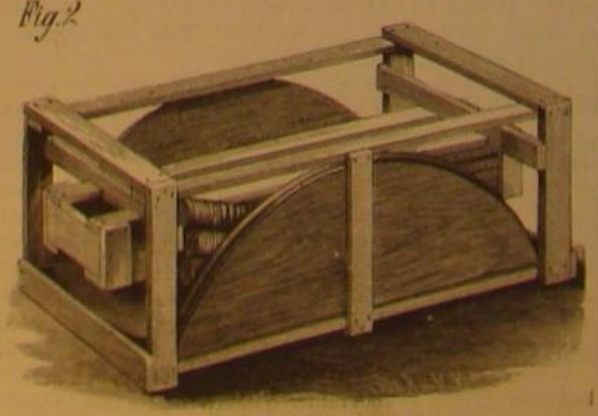


Fig. 1

Fig. 2



LANGSTON'S IMPROVED TABLE.

The cylindrical socket that extends upward from the lower edge of the angle brace, and within it, is of sufficient length to hold the table leg firmly, and the table is made fully as solid as with mortises and tenons. This socket may be screw-threaded and the table leg screwed in; or it may be plain inside, or fluted. From the upper edges of the wings sharp studs project for firmly holding the table top.

A table made in this way can be more readily put together or taken apart, knocked down for packing, and be more easily transported than those of ordinary construction, while at the same time it is strong, durable, and cheap.

Further information may be obtained by addressing the inventor, Mr. H J. Langston, Garrettsville, Ohio.

NEW INVENTIONS.

An improved stove mat for coffee pots and other utensils has been patented by Elizabeth C. Zumwalt, of Port Orford, Oregon. The invention consists in a mat made of a plate of sheet metal, having apertures and a handle to adapt the mat to be placed upon the top of a stove to receive a coffee pot or other utensil, the object being to prevent the bottom of the vessel from burning.

An improved balance for obtaining the lea of yarn has been patented by Mr. Thomas Finigan, of Mechanicsville, N. Y. The invention consists in a balanced scale beam provided at one end with a graduated scale, indicating the number of leas, and at the other end with a graduated scale with larger subdivisions, indicating the ply or number of strands of the thread, a movable unit weight being suspended from the latter end of the beam, whereas a certain length of the thread or yarn to be tested is suspended from the other end of the beam.

Mr. Curtis Griffin, of Middlefield, N. Y., has patented an improved adjustable frame as a substitute for the poles in raising hops. The invention consists in an upright having two crossed bars, with two cross pieces at the ends fastened to its top, which cross pieces have hooks at the ends to receive rings at the upper ends of a series of rods having rings fitting over the tops of a series of short posts around the upright, or on hooks at the upright, attached to their lower ends. The hop vines grow up on these rods, and the latter need only be unhooked when the crop is to be harvested.

An improved wagon brake has been patented by Mr. Robert Rutter, of Dillon, Montana Territory. The object of this invention is to facilitate the reversing of the brake roller, to allow the brake lever to be placed at the left-hand side of the wagon when the brake is to be put on by a man riding the near wheel horse, and to be placed at the right-hand side of the wagon when the brake is to be put on by the driver riding in the wagon.

Mr. Edward Ebi, of Cedar Rapids, Iowa, has patented an improved brake rod. The invention consists in a rod passing through journal bearings on the under side of the car, and provided at the ends with pivoted connecting bars having spring catches for keeping them united, which connecting bars are locked to the brake rods by means of a lever pivoted to the connecting bar and passing into notches of a loose and a rigid circular plate on the brake rod, so that all the brake rods of the several cars of a train will be revolved together and the brake shoes will be drawn against the wheels simultaneously.

An improved harrow has been patented by Mr. William J. Campbell, of Reed's Gap, Pa. The object of this invention is to provide means whereby the center bars of the harrow may be weighted by the side bars, and thus caused to make deeper cuts; and also to provide a harrow the tooth bars of which may be readily detached from each other for convenience in transportation and stowing away.

Messrs. Reuben R. James and Mirabeau N. Lynn, of Rising Sun, Ind., have patented an improvement in grain meters. This invention relates to apparatus for weighing and measuring the amount of grain that passes through it by devices actuated solely by the weight of the grain, and hence automatic in its operation. The invention is an improvement on the grain meter for which Letters Patent were granted to the same inventor February 22, 1881, No. 238,122.

An improved mail bag catcher has been patented by Mr. Calvin I. Kimball, of Portland, Me. This improvement relates to apparatus used on mail cars for catching mail bags, and have for their object to allow adjustment of the crane to the direction in which the car may be moving without removing the crane from its supports.

An improved tire tightener has been patented by Mr. Russell Jennings, of Sedalia, Mo. This invention relates to the class of tire tighteners which consist in a threaded bar or screw having a vertically movable clamp and a nut, by which, with the assistance of a winch, the said clamp is brought to bear against the fellies, and thereby separates the fellies from each other and from the spokes, where they have shrunk, the spaces thus created being filled with wedges.

Mr. Benjamin O. Branch, of Friar's Point, Miss., has patented a novel construction and arrangement of devices, for displaying in the cars the names of stations on a railway.

Mr. Carl A. Türpisch, of New York City, has patented an improved brooch formed of a wire bent in the form of a ring or in a similar manner, so that the two ends will be pressed against each other by the spring of the wire. To one of the ends a cap is attached in such a manner that it overlaps the point of contact of the ends of the ring, upon which ring a short sleeve is loosely mounted, and has a pin attached to it, this pin being passed through the article to which the brooch is to be attached, upon which the end of the pin is forced through between the ends of the wire into the cap, in which it is retained as the ends of the ring snap together, thus locking the point of the pin between the cap and the ends of the ring.

An improved attachment for seed drills has been patented by Mr. Howard M. Fordham, of Great Bend, Kan. The attachment has a rotary shaft with spirally arranged rods attached to the shaft which pass between the drill feet and push off collected rubbish, and springs are placed upon the rods to keep them clear of rubbish.

An improved astronomical clock has been patented by John L. Blair, of Clear Spring, Md. This invention relates to certain improvements in what are known as "astronomical clocks," designed to show by object-lesson the minutes and hours of the day, the day of the week and month, the daily revolution of the earth, the yearly revolution of the earth, the phases of the moon, the time for the different longitudes on the earth, the lunar revolution, the signs of the zodiac, the tides, and synodical as well as periodical time.

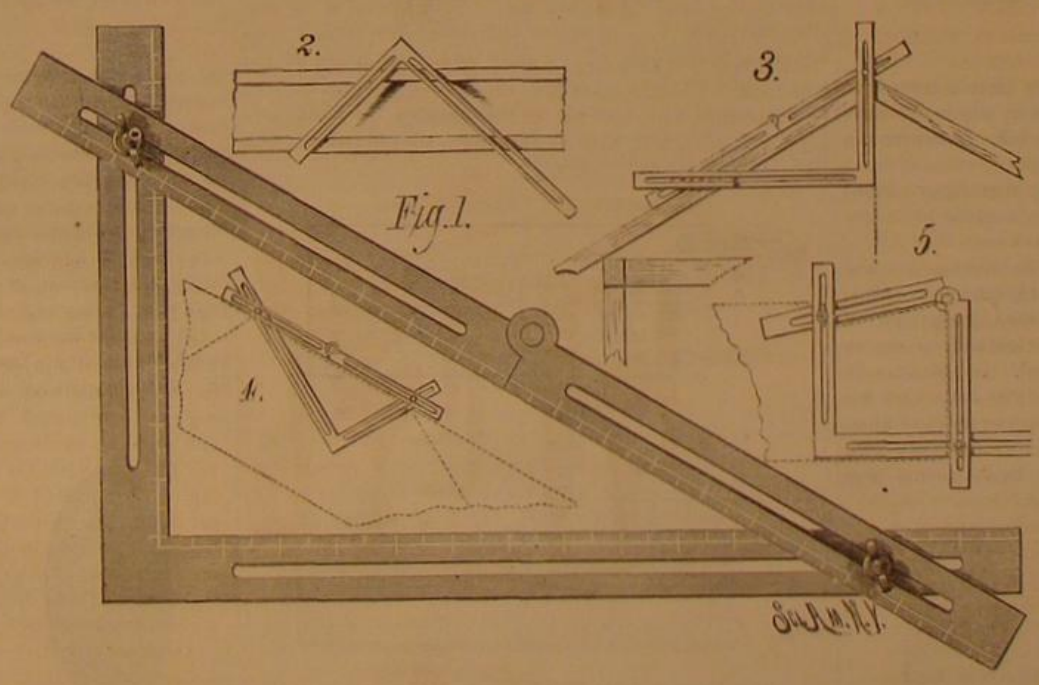
An improved sulky attachment for plows and harrows has been patented by Mr. Edwin M. Carroll, of Pittsford, Mich. This inventon consists in the peculiar construction and arrangement of the parts, which cannot be described without engravings.

Mr. Clinton O. Rockwell, of Roaring Branch, Pa., has patented an improved machine for cutting or pruning the runners from strawberry vines. This machine is provided with revolving knives which act against a hooked blade and cut the runners which are drawn upward by revolving hooks.

JOINTED PITCH-BOARD FOR SQUARES.

The engraving shows a carpenter's square provided with a middle-jointed rule slotted in both sections, and connected by clamp bolts and wing nuts with the slotted arms of the square. The form of the instrument is clearly shown in Fig. 1. The square as well as the jointed rule are made of steel and have suitable scales engraved on them.

This instrument can be used for laying out miter boxes in the usual way, as shown in Fig. 2. It may be used for finding the length and bevel of rafters, as shown in Fig. 3, and it is found very convenient when used as a pitch board in laying out stairs, as shown in Fig. 4. It can be used for laying out dovetails on timber, as shown in Fig. 5; and it may have a straight-edge attached to it, so that it may be used as an extended square, and it will be found very convenient in solving many other problems in carpentry and joinery. The arms of the rule can be set respectively parallel with the blade and tongue of the square; then be used to size or box timbers. The arms of the rule can be adjusted to the blade of the square and used as a double bevel. The pitch board can be used to find the diagonal of a square; can be used to solve problems in proportion, such as finding the length of stair-string from the pitch-board; can be used to find the lengths and bevels of hip and jack rafters; can be used to find the sides and angles of hoppers and splayed work. It is the only instrument known to us that solves the right-angled triangle without calculation or drawing, that is, approximately. This useful invention was recently patented by Mr. Frederick N. Marvick, of Palatka, Fla.

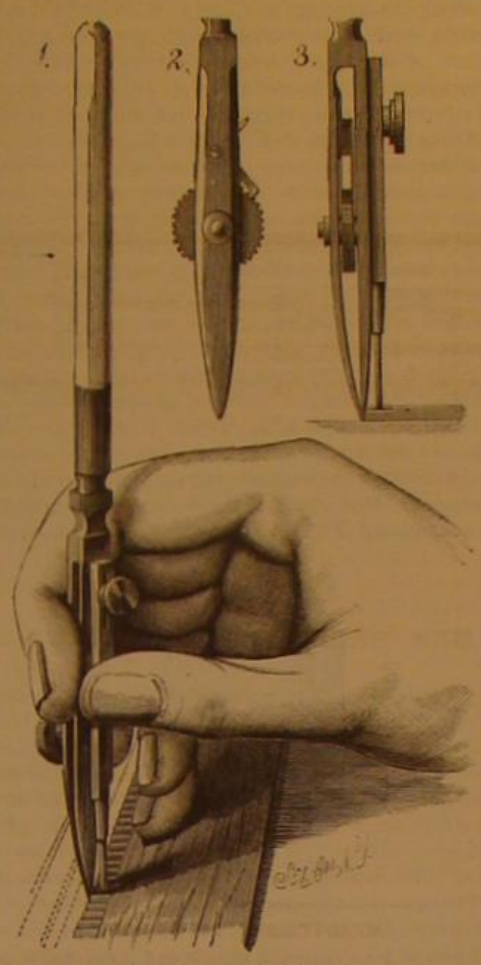


MARVICK'S JOINTED PITCH-BOARD FOR SQUARES.

CEMENT FOR REPAIRING GLASS.—Dissolve fine glue in strong acetic acid to form a thin paste.

IMPROVED DRAWING PEN.

The shading lines of a drawing must gradually increase in width toward the darker part of the drawing, and this is accomplished by increasing the distance between the points of the drawing pen a trifle after a line is drawn and before drawing the next line. This adjustment of the pen is not accurate, as the operator has no gauge to guide him, and relies entirely upon his judgment, and errors can hardly be avoided, except by using a drawing pen provided with some



NEW DRAWING PEN.

suitable gauge for adjustment, such, for instance, as is shown in the annexed cut.

Fig. 1 is a perspective view showing the method of making dotted lines. Figs. 2 and 3 are respectively front and side elevations.

The adjustment wheel is cogged, and its circumference is divided into a number of equal parts, which are numbered. An angular pawl is pivoted between the blades of the pen in such a manner that one end rests on the cogged adjusting wheel and the other end projects from between the blades, so that it can be depressed by the finger, raising the other end of the pawl from the surface of the wheel, which can be turned the distance of one or more subdivisions, as the desired increase in width of the line may require, upon which the pawl is released and locks the adjusting wheel.

If dotted or broken lines are desired a rule is used having undulations in its upper surface along the edge, and a pin or stylus is attached to that side of the pen toward the edge of the rule, the point of this pin resting on the undulated part of the rule. If the pen is drawn along the rule it will be raised and lowered alternately, and there will be corresponding breaks or interruptions in the line. The size of the blanks in the dotted line is governed by the size of the undulations of the rule. The pen has been patented by Wissmann & Wallegg, of Vienna, Austria.—*Wiener Technologische Blätter.*

The Ruby Gravel Company's Tunnel.

There is no part of the world where so much tunnel work is carried on as in California. There is, of course, more or less tunnel work in quartz mining, but in drift mining operations very long tunnels are necessary in many cases for "bottoming" the gravel channels. Long tunnels have often to be run in hydraulic mining work also. As an instance of quick work in this line may be cited the tunnel being run by the Ruby Gravel Company, in Cariboo ravine, one mile south of Rock Creek, Sierra county. It is thus briefly described by the local paper, the *Mountain Messenger:*

Work was commenced last December, and since that time 2,050 feet of tunnel have been made. In round numbers the tunnel, all but a few hundred feet of the outer end, is 10 feet square, nearly all through hard rock that required blasting, and that stands without timbers. For 1,950 feet, the tunnel follows an air line, the course being a little north of east. The last 100 feet is turned to the south 17° from the former course. The grade of the tunnel is half an inch to 12 feet. At the mouth of the tunnel the company have a substantial engine house, and a powerful engine which drives the air compressor and a Struve two-plunger ventilating pump. From the compressor the air passes to a large upright reservoir of heavy boiler iron, about 10 feet in height and 4 feet in diameter. From this reservoir the air is taken, under a pressure of 50 lb. to the square inch, in 4-inch wrought iron pipe, to the drills, running along the bottom of the tunnel.

The air from the ventilating pumps is taken in a 12-inch air pipe and boxes to near the face. The last 150 feet of tunnel is in softer rock, a species of quartzite, so hard as to require blasting, but not hard enough to stand long without timbering and spiling. About 150 feet from the face a shaft has been started, and is now up about 40 feet in blasting rock. It is designed to test the question as to whether or not there is gravel overhead. Mr. H. Jennings is now superintendent of the works, Mr. H. Wallis acting in the capacity of consulting engineer. Mr. Edge is the engineer in charge of the machinery. For rapidity of construction and size of tunnel, there is probably nothing in California that exceeds this work. From its inception until within a few weeks H. Wallis has been superintendent in charge, Hamilton Smith, Jr., being superintendent-in-chief.

The First Electric Railway in Great Britain.

Ground was broken the last of September at Portrush, Ireland, for an electric railway to the Giant's Causeway. Dr. Siemens is said to be a large contributor to the new enterprise. It is estimated that the expenses for haulage on a tramway such as this with horses would be twenty-three cents per mile, and by steam about fifteen cents, while it is supposed that the working expenses by an electrical motor will not reach two cents per mile.

New Columbia.

The hitherto inaccessible northern land known as Wrangell Land was "occupied" and claimed for the United States, August 12, by Capt. Hooper, of the U. S. Revenue steamer Corwin. In a letter to the Chief of the Revenue Marine Bureau, Capt. Hooper says:

"We took possession, planted the American flag, and now we want to give it a new name, as I believe we are entitled to do. I propose to call it 'New Columbia.' The land north of the continent, to the east, is all named for the English, and the islands further west are called New Siberia, so it seems to me that to call it New Columbia would be appropriate, and less likely to give offense to those who are interested in the old names on the different charts than to give a name of a less national character. Wrangell never saw the land, and after trying for three successive years to get a sight of it, refers to it as the 'problematical land of the north.' Neither was he the first to report the existence of it. The object of his cruise was to investigate the truth of the reports to that effect brought by previous travelers. Kellet, after whom it is called on the English charts, only dimly saw what he supposed was a small island, and which he called Plover Island. That is where we landed, at the mouth of a good sized river on the east end, which now appears on our chart as Clark River."

The new land is crossed by the meridian of 180° from Greenwich, the shore surveyed lying three or four degrees to the eastward of that meridian. Its southern point is about 71° north latitude.

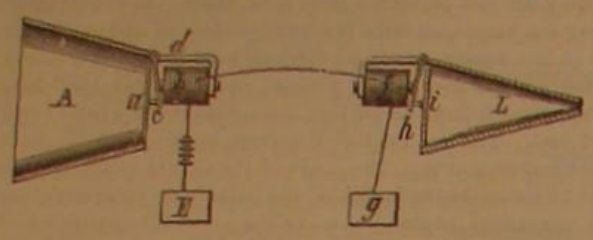
TO REMOVE INK STAINS.—Take of muriate of tin, 2 parts; water, 4 parts. To be applied with a soft brush, after which the paper must be passed through cold water.

THE TELEPHONE.—JUDGE LOWELL'S OPINIONS COMMENTED UPON.—INGENIOUS TRANSFORMATIONS.

BY NOTSKEE.

A few days ago I chanced to see a small pamphlet that is being sent out by the American Bell Telephone Company to their agents, and containing the decision of Judge Lowell in relation to the alleged infringement of the so-called Bell telephone. Having been wrestling with the element electricity, experimentally and otherwise, for a number of years, and with acoustics and other forms of telephones, I at once found the pamphlet very interesting and exceedingly amusing.

Now, basing my opinion upon Judge Lowell's decision, I cannot believe that he had very much aged telephonic information laid before him by the defendants; for if he had his conscience would never have allowed him to render such an opinion. I may look at the judge's printed opinions in too



Bell's Apparatus.

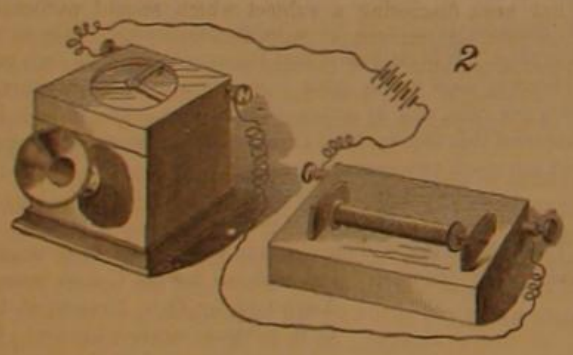
strong a light, and I may not understand them just as he would have me; but be that as it may, I do think that when he rendered this now famous decision he little thought of what valuable material he was furnishing for the future use of the defendants. Take the following for example—the Italics are mine:

"There is some evidence that Bell's experiments with the instrument, described in Fig. 7 (see Fig. 1), before he took out his patent, were not entirely successful; but this is now immaterial: *for it is proved that the instrument will do the work, whether the inventor knew it or not.*"

Now, if that is rock bottom law, Bell and his followers (especially the "followers"—for Bell is out of the business, slick and clean) must feel a little squeamish; because—according to the above ruling - the father of the telephone, and the rightful claimant, would be the person who took out the first patent upon an instrument or apparatus that would transmit articulate speech, "whether the inventor knew it or not."

Who is the fortunate parent?

Reiss, undoubtedly, was the first to discover and make public the fact that articulate sounds could be transmitted telegraphically. But, according to Judge Lowell, Reiss can-

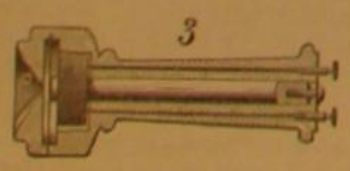


Reiss's Telephone.

not be credited with it, because, before Reiss's discovery there were thousands of instruments in use, and being made daily, that would transmit articulate speech, "whether the inventors knew it or not."

There is great satisfaction in knowing that Reiss cannot come down on us for exorbitant rentals, because he is not protected (?) in so doing by U. S. patents.

Why did Reiss neglect to patent his discovery and apparatus? Probably because he did not attach much importance to the discovery, or else that he was satisfied that he had not made an invention, and was too conscientious to try to inveigle any one into the belief that he had. It would not do to credit it to Reiss anyway, because he *did know* that his apparatus (telephone) would work, and gave an exhibition of the same (see Fig. 2) before a body of learned gentlemen, as early as 1861—fifteen years before Bell's patent was applied for.

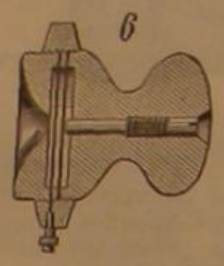


Morse, "his heirs or assigns," cannot bring in a legal claim for the telephone, because the Morse patents have expired. But then it might be credited to him, for two reasons: First, because he is dead and cannot object; second (Judge Lowell's reason), because Morse's instruments will transmit articulate speech, "whether the inventor knew it or not."

Here is another quotation: "But Bell discovered a new art, that of transmitting speech by electricity." Now why not give Judge Lowell a patent for the discovery of a new art—the art of discovering that *Bell* was the discoverer of the art of transmitting speech by electricity? Certainly no one but Judge Lowell has made this discovery, therefore he is entitled.

How, in the name of common sense, Bell can be credited with making the discovery of "a new (?) art," when, as long ago as 1861, Prof. Reiss published and gave to the world full particulars of this same "new art;" and not only Bell, but all other scientists throughout the globe were acquainted with the facts? Perhaps they were not aware of it at the Patent Office at the time Bell put in his application. It is not well that the examiners in any department should be thoroughly posted; because if they were it would greatly lessen the number of new patents issued upon old devices, and that would never do, for the business of the Patent Office is to issue patents—the more the merrier. Never mind whether they will hold water or not; the Office grinds them out, medical college fashion, and the people must abide by the results.

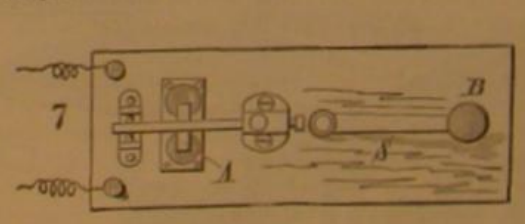
The judge is probably correct when he says: "It seems to me that the defendants use both the method and the apparatus of Bell." There is not a particle of doubt about that; but what did Bell use for his experiments, and as a model? Simply nothing but the methods and the apparatus of former experimenters. How much of the so-called Bell telephone, as now constructed (Fig. 3), was invented or contrived by

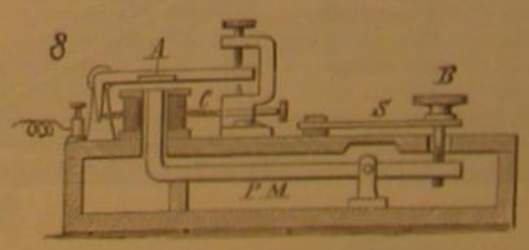


Dolbear's Receiver.

Bell? The most reliable information upon the subject credits the "permanent magnet" (as applied to an instrument constructed purely for telephonic purposes) to Prof. Dolbear, of Tufts College; the "converging mouthpiece," Fig. 4, to Prof. Pierce, of Providence, R. I.; and the general makeup of the instrument into the "butter-stamp" form, Fig. 5, to Edson S. Jones, of the same city. The butter-stamp form of telephone, Fig. 5, is the one now in general use. Compare it with Bell's apparatus, Fig. 1.

In referring to the Reiss telephone, the judge says: "The regret of all its admirers was, that articulate speech could not be sent and received by it," all of which is an exceedingly elevated mistake, for the Reiss apparatus will transmit articulate speech, and as perfectly as any of the hundreds of other forms that have since been constructed—a fact that is well known by telephone investigators throughout the land. Also, that "a Bell receiver must be used to gather up the sound before the instrument (Reiss's) can even now be adapted to a limited practical use." Bosh! Can it be possible that Judge Lowell *believes* such nonsense? Has he been mixed up in this case, all this time, and never heard of the simple little receiver contrived by Prof. Dolbear (Fig. 6)—an instrument that contains neither magnet nor helix; and yet it is a perfect receiver for the Reiss transmitter—a fact that explodes the above claim?

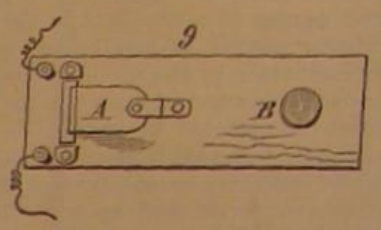


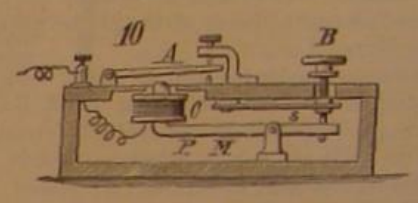


I devoted considerable time last winter to the examination of the Patent Office reports for the self-satisfaction of knowing what had been patented in the electrical line, in years gone by, that bore any relation to the articulating telephone of to-day. And, without entering into details, suffice it to say that I found one instrument—a "magnetic sounder"—patented by one Wm. Humans in 1874, two years before Bell was heard of, and containing every part—armature, helix, and *permanent* magnet—of the most perfect magneto telephone as now made; and without one particle of alteration in adjustment or change in construction, it answers nicely for transmitting and receiving articulate speech.

Within a few weeks I have had the pleasure of using these instruments, both double and single helix, for conversing over lines of considerable length, and the results were quite satisfactory—equally as good as I have obtained from many forms of specially constructed telephones.

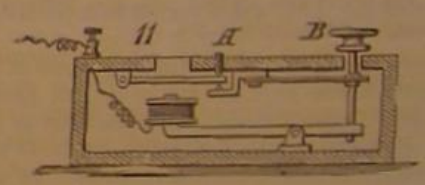
Fig. 7 is a top and Fig. 8 a side view of the magnetic telegraph instrument. A is the soft iron armature; C, the coils; P M, the permanent magnet; and in this instrument it is of horseshoe form, with both pole ends turned up at right angles, and carrying the coils, C. The spring, S, retains the magnet in its normal position. The instrument is operated by working the knob, B, in the usual way; and it is so simple in adjustment, etc., that the merest tyro cannot fail to understand. To work it as a transmitter and receiver of articulate speech, you will simply hold or fasten down the knob, B—which will bring the magnet and armature nearly together; then talk and listen closely to the armature, A. A paper cone fastened around the helix will augment the sound very materially; but it is not necessary, for it will work nicely without it or any changes or attachments whatever.





The single helix instrument is of a much cheaper form, and as a transmitter and receiver of vocal sounds is superior to the double helix sounder. Fig. 9 is a top and Fig. 10 a side view.

To save expense in finish the spring, S, and spool, C, are placed within the case; and all metal work reduced to the lightest and plainest form. In principle and operation it is identical with Fig. 8. To make it still less expensive in construction the armature can be placed within the case, as shown in Fig. 11, and the adjusting screw, H, left flush with



the top. The key knob, B, remains above the surface as before, for the purpose of operating it. And as a "sounder" it works equally well this way. Is there any difference (patentable) between Figs. 8 and 11? None whatever! Put on a converging mouthpiece over center of armature, like Fig. 12, and you can call it a "sounder," or a "telephone," whichever suits your fancy. No battery is required, and as to "currents"—whether they are vibratory, disturbed, undulatory, intermittent, or pulsatory—they are all there—"you pays your money and takes your choice."

Let us make the case in an oval form, instead of square, and bring the line wires out at the bottom, as shown in Fig. 13. Now compare it with the Phelps telephone, as illustrated

on page 23 of Prescott's book, "The Speaking Telephone, etc.," and as shown here, in Fig. 14, and tell me if they wouldn't make pretty fair twins?

Franklin, Mass., September 19, 1881.

MECHANICAL INVENTIONS.

An improved wagon scale has been patented by Mr. Jacob Mills, of Marshall, Col. The invention consists in constructing a wagon scale of sets of compound levers connected with the bolsters of a wagon having a cross bar resting upon their short arms to support the wagon body and its contents, and having a scale beam connected with the long arms of the said compound levers, so that the wagon body and its contents can be conveniently weighed.

Mr. Jacot Burmann, of Bienne, Switzerland, has patented an improved watch provided with devices for indicating the day of the week and month, the month of the year, and the moon's phases.

Mr. David J. Harrell, of Cochran, Ga., has patented an improvement in motors or mill powers, such as are placed on scows moored in a stream and adapted to be driven by its current. The inventor employs a rotating current wheel, provided with floats or buckets, and placed vertically in the usual way between two boats or floating structures that have like buoyancy and are rigidly connected, so as to move together as the stream rises or falls. He provides an automatic connection between the wheel and the machinery of a mill or factory located on the contiguous bank of the stream, so that no interruption in the operation of the machinery can occur by variation in the height of the water.

An improved spring attachment for whiffletrees, for the purpose of relieving the shoulders of the draught animals of jars or shocks, has been patented by Messrs. Frank S. Wagenhals and Chauncey P. King, of Columbus, Ohio. The attachment may be applied to a double-tree or whiffletree.

An improvement in breech-loading firearms has been patented by Mr. John H. Gramps, of Stone Arabia, N. Y. The invention consists in a breech plate pivoted to swing transversely to the barrel, and in a spring extractor combined with the breech plate.

An improved machine for spinning, doubling, and respinning silk has been patented by Mr. Francis Seymour, of Paterson, N. J. The invention consists in means for automatically throwing the spool-bearing tube out of gear when the thread breaks; also, in improved means for winding the thread solidly upon the spool.

An improved apparatus for concentrating ores has been patented by Mr. Arthur G. Charleton, of Marmora, Ontario, Canada. The apparatus is constructed with a series of settling compartments having inclined bottoms, and a series of divisional compartments having central partitions and side partitions, inlet passages to admit ore, outlet passages for the escape of the water and lighter ore, and discharge passage for the escape of the heavier ore.

An improved three wheeled vehicle, patented by Mr. Lorenzo D. Hurd, of Wellsville, N. Y., is so constructed that the vehicle can be turned in small space, that the whipping of the tongues will be prevented, and the vehicle will not be liable to tip over should the loading be unevenly placed upon them.

An improved railroad signal, patented by Mr. Joseph C. W. Stout, of Farmingdale, N. J., is designed to prevent accidents that occur at night or by day on railroads from the color-blindness of the engineers. Switch signal lights ordinarily present but one point of light, which to those afflicted with color-blindness is with difficulty distinguished from other lights about it, its apparent form being the same with them. This invention consists of a light night signal, presenting an elongated beam or bar of light, and capable of being moved in a vertical plane, and rotated at the same time, so that the beam of light may be presented vertically or horizontally, the intention being to provide a light signal that can, by its shape or form, be distinguished from all surrounding lights.

Mr. William W. Button, of Shenandoah, Iowa, has patented an improvement in railroad snow plows in which hinged and adjustable wings are used. The invention consists in affixing a heavy iron beam to the platform of a flat car and attaching to its extremity a vertical support. To this support is riveted a vertical knife or cutter, extending from within an inch or more of the ground up to any desired height. In the rear of the cutter two wings are strongly hinged to the beam, and held in position and adjusted by chains attached thereto and passing around a windlass, the windlass being fastened to the beam near its interior extremity.

Locking Railway Car Doors in England.

The locking of the doors of railway carriages is one of the mysteries of railway management. No passenger has ever been able to divine why such infinite pains are taken to lock him in. The only result of the process is that if there is an accident he is a prisoner, with a chance of being killed. If, on the contrary, his train arrive safely at his destination, he is still a prisoner, who has to wait till he is liberated, making, meanwhile, spasmodic signals to attract some friendly porter for the purpose, unless, having grown wise by experience, he carries a key himself, and is able triumphantly to emerge. Some people imagine that a regulation of the Board of Trade obliges this extraordinary precaution. No such regulation, however, exists. On the contrary, the greatest diversity of practice prevails on the subject. One company locks its carriage doors on the main line only, another on the branch and main lines both, a third on single lines only, a fourth does not lock its doors at all. And the extraordinary thing is, that the companies that entirely neglect the custom find no disadvantage whatever in doing so. On the contrary, their porters are able to attend to other matters during the time when they would have been locking and unlocking doors.

The following are the railway companies who do not lock their doors on either side of their trains: In Scotland—the Glasgow and Southwestern, Great Northern of Scotland, Highland and North British. In England—Great Eastern, London, Chatham and Dover and Northeastern. It is hard to see why in these days of falling dividends other companies do not follow their example.—*Pall Mall Gazette.*

On the Estimation of Nickel in the State of Sulphide.

BY ANTONY GUYARD (HUGO TAMM).

Analytical chemists know what a tedious operation it is, after obtaining nickel in the state of sulphide in the usual course of analysis, to have to redissolve this sulphide in acids, to filter the solution, and to precipitate it with a fixed alkali, in the form of an oxide of nickel which it is most difficult to filter and to wash thoroughly. It is in order to simplify these long and troublesome manipulations that the writer has devised the following method, which gives quite satisfactory results for most practical purposes.

Nickel having been separated by the usual methods from the metals which accompany it, is precipitated, as usual also, in the state of protosulphide, NiS, by means of a stream of sulphureted hydrogen. The precipitate collected on a filter, and washed, is calcined while still wet, in a porcelain crucible, until the combustion of the filter is complete. (Strange as it may appear, in these conditions no oxide of nickel is formed.) A little pure flower of sulphur is then thrown in the crucible, which is immediately covered with a well fitting porcelain cover, and the whole is heated over an ordinary Bunsen gas burner, until the excess of sulphur has been driven off. The residuum left in the crucible is a sulphide of nickel, which, after cooling, can be used for the estimation of nickel with as much accuracy as when this metal is weighed in the state of oxide; for, obtained in the conditions which have just been described, and which, it will readily be perceived, are those of ordinary analysis, this sulphide possesses the invariable formula, NiS_2, and a corresponding fixed composition from which the weight of nickel is calculated. This bisulphuret of nickel, thus obtained, is quite black, non-magnetic, and in the shape of a fine powder. This last remark is made in order to call attention to a very curious fact.

When pure oxide of nickel, such as the one obtained for the estimation of nickel, is heated with a little excess of flower of sulphur in a covered porcelain crucible, no bisulphide is formed, but a magnetic sulphuret of nickel is obtained in small semi-fused lumps, with a bronze tinge and luster. In certain cases the formula of this magnetic sulphuret is Ni_3S_4, but, according to the length of time it is heated over the Bunsen burner, its composition varies sufficiently to render it totally unfit for the estimation of nickel. Its color and magnetic properties remain unaltered, but the composition varies.

Similar researches on cobalt would be highly interesting and useful to the analyst, but the writer has not carried on further these investigations.

Luminous Meteors.

At the recent session of the British Association, York, Professor A. S. Herschel read the report of the committee on luminous meteors, in the course of which he referred to the aerolite which fell near Middlesbrough this year, and embedded itself to a considerable depth in the earth. It was estimated that it struck the earth with a velocity of 402 feet per second. There was no doubt it fell at least forty miles. The committee recommended that as the information they had received was of such a miscellaneous character, they should not make any further reports for a few years.

Sir William Thomson said the great majority of meteoric stones, instead of falling to the earth in a solid mass like the one produced, generally got shivered to pieces in the air through becoming so intensely hot.

Prof. Herschel observed that the stone in question had not been exposed to any great heat.

Sir William Thomson observed that in all probability some of the vegetation existing was of meteoric ancestry. The stone in question was not on the earth a quarter of an hour before it was picked up, and it was certain that it came from outside the earth. He also said there was a general consensus of sentimental belief that in many other bodies in the universe there was something like the life on this earth, but that was not a scientific belief; however, science was in what might be called a skeptical condition. Life elsewhere was a possibility, and science only went the length of saying that life *elsewhere* was not impossible. At the same time he did not say that the sentimental belief might not be as well founded as any scientific belief, but all he could say at present was that such a belief was not founded on scientific grounds.

The Cedars of Lebanon.

The once famous and extensive cedar forest of Lebanon, according to a writer in the Vienna *Politische Correspondenz*, has dwindled down to the dimensions of a mere thicket, numbering about four hundred trees. To save it from complete destruction and preserve it at least in its present extent, Rustem Pacha, the Governor-General of the Lebanon, has issued a special ordinance, containing a series of stringent regulations calculated to check, if not quite to put a stop to, the vandalism and carelessness of most travelers. It is expressly forbidden to put up tents or other kinds of shelter within the district of the trees, or to light fires or cook any provisions in their vicinity. No one is allowed to break off a bough or even a twig from the trees. It is forbidden to bring any beasts of burden within the district. Should oxen, sheep, goat, or other pasturage cattle be found within the prescribed limits, they will be irredeemably confiscated.

Weldless Ring Plates for Boilers.

J. Windle, of Manchester, has designed a mill to roll weldless ring plates for boilers from 2 feet diameter up to 14 feet, and 4 feet wide. The object of the invention is to avoid the longitudinal seams in boilers, which are necessarily a source of weakness, and this is accomplished by constructing the shell of the boiler of metal rings connected together, and formed by a rolling operation from an ingot of steel, or from a bloom or mass of metal, in a similar manner as when rolling railway tires, the ring being formed without a joint, seam, or weld. In the rolling mill which has been specially designed for this work, a fixed and a movable roller, adapted to roll the required rings, are employed. The axles of these rollers are provided with top bearings, and to enable the ingot ring or mass of metal to be placed in position and the rolled ring to be removed, the upper bearing of the movable roller is arranged to be withdrawn. This bearing is fixed on the outer end of a lever or lever frame, which is hinged to a sliding standard or carriage connected with the carriage which carries the movable roller, the sliding standard being actuated by means of hydraulic cylinders. Vibrating frames are also employed, each carrying two, three, or more rollers in place of one the upper ends of the studs or shafts being stayed. A number of the carrying rollers are converted, by means of bevel or suitable gearing, with revolving shafts, so that they assist in the carrying round of the ring. In working out this method of rolling a hole is punched in the ingot or bloom, and a mandrel introduced. The mass of metal, with the mandrel in position, is then placed under a steam hammer in a swage, which is formed to confine the metal sideways, so as to produce an extension of the length under the blows of the hammer until a rough cylinder of sufficient length is obtained, but in some cases the ingot is cast in the form of a hollow cylinder, which, when necessary, is elongated in the manner above indicated. These ring plates can be produced in any required shape, and with flanged thickened edges if necessary, and we understand that a company is being formed to put down the necessary plant for the manufacture of boilers and plates on this principle.

The Fatal Worry.

In a leading English periodical, Dr. Mortimer Granville has been discussing a subject which should particularly interest all impetuous brain-workers. Referring to the increasing number of cases of sudden collapse from alleged "overwork," Dr. Granville offers some views which, if not exactly new, are at least not those currently entertained.

Constant warnings are being given at the present time against overwork. But, thinks the author quoted, these are generally misapplied. The brain can be tired by prolonged activity, just as may happen with a muscle. But we find that hard and persistent muscular work does not cause muscular collapse. Each day the reserve forces of nutrition renew the wasted protoplasm, and the frame keeps as strong as ever. So there is no more reason why there should be brain collapse from systematic, though severe brain work, than there is for paralysis or tetanus to strike down athletes or day laborers. And we do, indeed, find that brain workers are, as a rule, long-lived.

The cause of the frequent breaking down of men engaged in the active work of life is referred, therefore, by Dr. Granville, to another source, and that is worry. Doubtless it is no new thing to be told that it is not work but worry which kills. But it is often useful to have general impressions fixed upon a definite and more or less scientific basis. Therefore we follow our author in the expression of his views.

It may be assumed that, as the contraction of a muscle is caused by successive waves of nerve impulses, so the mental activities are made up, after an analogous fashion, of undulations of nerve impulses. In ordinary work, however hard, these impulses are sent out in a regular and rhythmical manner. It is the worry which comes in and disturbs this rhythm, exhausts the nerve force, exhausts further the reserve or recuperative power, and breaks down the man. The strength does not weary of digesting digestible food; but add an unmasticated bolus of tough beefsteak three times a day, and there will be trouble eventually. Worry produces a kind of dyspepsia of the mind. It is to the encephalon what a restaurant pie is to the stomach.

The first inference from this presentation of the matter is easy and natural. It is that we should not worry. Such advice is perhaps the most *fruitless* that can be possibly given. Nevertheless, a diligent inculcation of it, and especially its application in educating the young, may not be without some avail.—*Medical Record.*

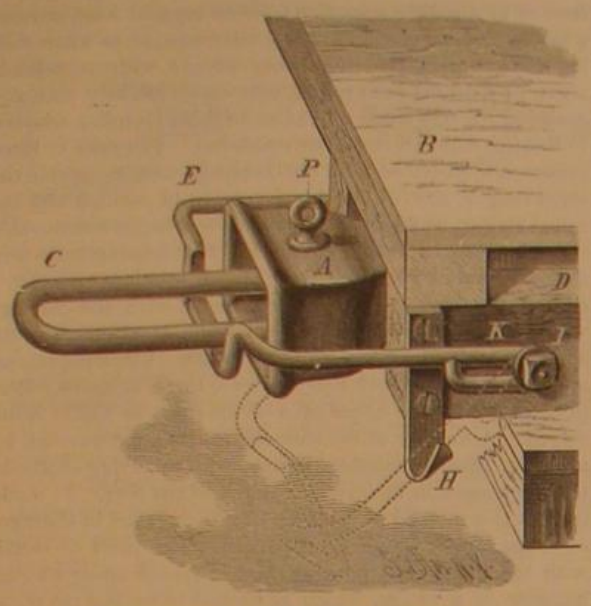
NEW METHOD OF PREPARING CHLORINE.—J. Townsend, of Stassfurt, prepares chlorine by mixing a heated solution of magnesium chloride of 40° to 50° Baumé with about ten per cent of manganese dioxide, and then exposing it to the action of heated air, whereby the chlorine is liberated, which may be used in the ordinary manner. The process is facilitated by the addition of 25 to 50 per cent of calcium chloride.—*Dingler Poly. Jour.*

NEW CAR COUPLING.

This invention is the outcome of a long and continued observation of all appliances and devices used in coupling cars where any ordinary link or pin is used, and an extensive acquaintance with many unfortunate brakesmen and yard men who have been crippled for life by being caught between two meeting drawheads.

This invention consists of a swinging bail, E, which may be pivoted to the sides of the drawhead, or to the longitudinal sills, D, placed on either side of the drawhead.

The bail, E, is bent downward in front to receive and raise the link in proper position for entering the opposing drawhead, the ends of the bail being arranged with slots, K K, which allow it to yield to any stroke or pressure it may receive from the opposing drawhead.



JOHNSON'S SAFETY CAR COUPLER.

The construction and operation of the coupling may be easily understood from the cut, in which B represents a broken off portion of the platform of a car, A an ordinary drawhead, C a link, and P a pin. D D are longitudinal sills, to which the bail, E, is pivoted by means of bolts or screws, I I, a portion of the platform being broken away to show the same. H H are supporters upon which the bail, E, rests when not in use, as shown by dotted lines. The operator takes the bail on either side, raises it up, and with it lifts the link and holds it in position to enter the drawhead of another car. When released from the operator's hand it falls down and out of the way and remains in position for use.

The bail may be easily and cheaply made, as it may be all bent on forms from a single bar of iron. This coupler is very cheap and simple, and can be adjusted to any freight car or caboose without changing car or bumpers. It is worked from either side of the car with or without a lever, alleviating the necessity of reaching in between the two meeting cars for the purpose of guiding and lifting the link.

The bail itself is a protection to the operator against falling, especially when the cars start unexpectedly, as is often the case.

This invention has been tested in the Wabash car shops of Toledo, and found very satisfactory.

For further information address Mr. Ferdinand Johnson, 237 St. Clair street, Toledo, O.

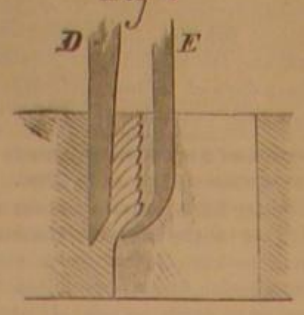
IMPROVED MORTISING MACHINE.

The engraving represents an improved mortising machine recently patented by Mr. John C. Fiester, of 320 South Eleventh street, Reading, Pa. The object of this invention is to provide means for the automatic removal of the chips from the mortise as they are made by the chisel.

The larger engraving is a front elevation of the machine. The smaller one shows the manner in which the chips are removed from the mortise. The crosshead, B, has a vertical reciprocating motion between housings, and is fitted with lugs at the top and bottom, as guides for the chisel mandrel or carrier. Between the lugs on the chisel mandrel is placed a slotted sleeve, C, fitted at its upper end with a collar having a recess or indent, a curved spring pressing the upper end of the lever, E, and a projection or cam capable of engaging the lever. The sleeve, C, is fitted at its lower end with a stop collar, the sleeve passes through the adjustable trip guard, A, and reciprocates with the crosshead, less the length of slot where it slides on a starting pin. The trip guard, A is made adjustable vertically by wing nuts and slots, the object being to permit of its adjustment to suit the respective positions of the sleeve as the crosshead, B, is set to suit different thicknesses of timber in mortising, the guard, A, always requiring to be adjusted relative to the positions of the sleeve in order to assure the actuating of lever, E, at the proper time. Fitted to the chisel mandrel there is a chisel socket, D, to which is pivoted the lever, E, curved near its lower end to permit its grasping the chips.

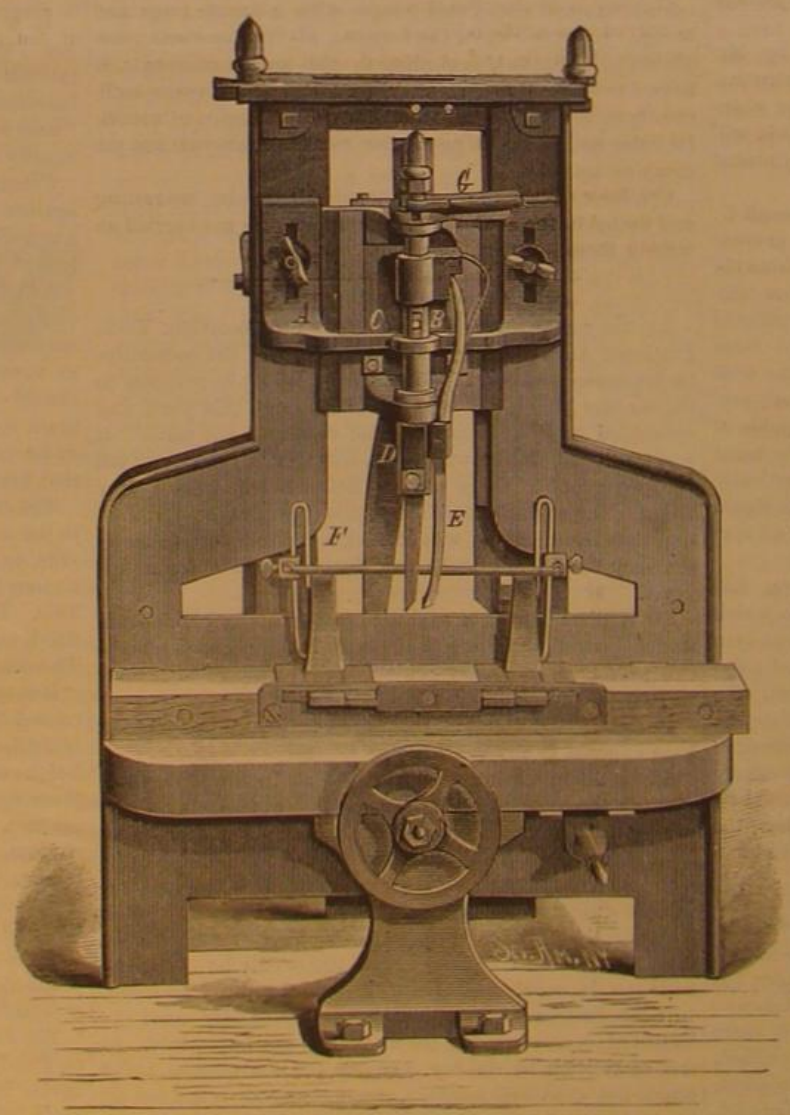
The operation of this machine is as follows: The timber

Fig 2



being secured to the table, the crosshead, A, is then set to the proper height relatively to the length of chisel and thickness of timber. The reciprocating motion is imparted to the crosshead, D, by a crank or eccentric. It is provided with an extension pitman to permit of adjustment of crosshead to various positions of vertical adjustment relative to the position of the crank and thickness of timber worked. One or more holes are bored to permit the entrance into the mortise of the lever. The trip guard, A, is then set in such position relative to the travels of the sleeve and chisel mandrel respectively, that it will arrest the travel of the sleeve by contact with the collar on the upper end of the sleeve just as the chisel is at the bottom of the mortise, and permit the mandrel to pass the length of the slot in the sleeve below the bottom of the mortise, and allow the lever, E, to grasp the chips and remove them from the mortise, as shown in Fig. 2.

Further information may be obtained by addressing Messrs. Fiester & Ammon, 320 South Eleventh street, Reading, Pa.



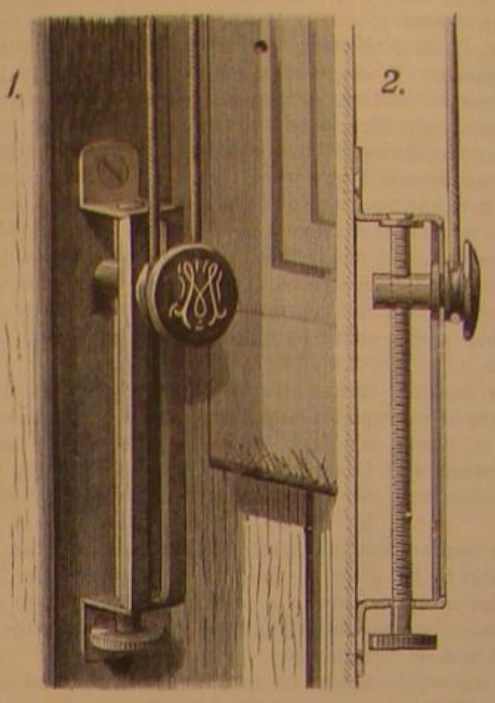
FIESTER'S MORTISING MACHINE.

Hilo Escapes the Lava Flow.

The *Advertiser*, of Honolulu, Sandwich Islands, says in its issue of August 24: "The lava flow, which has so long been threatening Hilo, may at last be regarded as at an end. In fact, it is quite impossible for it to come down again by the same channel which it has been using for the past nine months. As the support of the flowing lava in the tunnel beneath has been withdrawn, the roof has cooled, contracted, and fallen in, thus blocking up the tunnel, and also affording countless vent holes by which the molten mass might escape, even if it could overcome the obstacles offered by the *débris* which strews its path. A gentleman who has given careful and scientific attention to the flow, tells us that he had followed its course for over six miles, and that for the whole length of that distance the roof had caved in, say, every 150 feet or so. Another favorable indication of the cessation of the flow is the dense black smoke which is now rolling up from the terminal crater. This has usually been noticed at the close of former eruptions and flows. As long as the flow continues to advance, as long as the liquid lava pours out, the smoke is of a whitish color, but as soon as it becomes black, the danger, as a rule, may be regarded as at an end."

IMPROVED CURTAIN-CORD TIGHTENER.

We give an engraving of an improved curtain cord tightener patented by Messrs. F. E. Porter, of Baltimore, Md., and D. A. Beatson, of New York city. This tightener is mechanically correct in principle, simple and cheap in con-



IMPROVED CURTAIN-CORD TIGHTENER.

struction, and perfectly answers the purpose for which it is intended.

The frame of the device consists of a suitable piece of sheet metal having a longitudinal slot, and bent twice at right angles at either end to form ears, which are perforated for the securing screws or tacks. This portion of the device is conveniently struck up at one operation by means of a die. A screw extends from end to end of the frame, being secured after the manner of a rivet at the upper end, but being free to turn. At the lower end the screw is furnished with a milled head. A threaded block is mounted upon the screw, and to it is secured a roller. This roller receives the curtain-cord, whose tension may be readily regulated by turning the screw by means of the milled head.

Further information in regard to this invention may be obtained by addressing Mr. F. E. Porter, 33 South Charles street, Baltimore, Md.

RECENT INVENTIONS.

Mr. Theodore D. Lockling, of San Mateo, Costa Rica, Central America, has patented an improved method of securing covers to umbrella frames, so that they can easily be changed at will. The invention consists of the combination with the handle and notched and perforated ribs of an umbrella, of elastic rings, clamps, clips, and loops.

An improved watering pot has been patented by Mr. George F. McIntosh, of Hallowell, Me. The object of this invention is to facilitate the convenient changing of the delivery nozzles of the pot and prevent waste of water in supplying potted plants. The watering pot is provided with a closed top, upper and lower orifices to receive changeable nozzles, and a filling aperture and funnel on the rear above the handle.

In some of the Southern States there are large tracts of land that are infested by the "cutting ant," which destroys all vegetation, some of these tracts being literally undermined by them. Mr. Hiram B. Gray, of Columbus, Texas, has patented an improved apparatus for destroying these pests by blowing into their nests sulphurous or other poisonous fumes.

An improved table-leaf support has been patented by Mr. Horatio J. Locke, of Belfast, Me. The main object of this invention is to improve table-leaf supports so that the spring will only be allowed to exert its greatest power when supporting the leaf.

Mr. Joseph C. Higgins, of New Brunswick, N. J., has patented a detachable calk for horse-shoes, which can be attached to or detached from the shoe without removing the shoe from the horse's hoof.

An improved winding roller for looms, etc., has been patented by Mr. John Connelly, of Hallowell, Me. This invention relates to cloth-winding rollers used with looms to receive the cloth, and paper machines for winding the paper, and in winding web of other material, the object being to allow convenient removal of the material after being wound.

Protection in England.

To a country without competitors free trade may be a good thing. But when foreign competition arises to cut the ground from under the home laborer or to prevent the establishment of new industries free trade does not appear to work so well. Of this truth England is now gaining bitter experience; and as a natural consequence the more intelligent manufacturers are taking ground against free trade in favor of protection of home industry. As an illustration of the manner in which closet theories go to the wall when faced by the stern necessities of actual business life, nothing better could be asked than this change of front by many English manufacturers. The practical working of free trade in their case is forcibly put by Mr. John Lister, of Bradford, the founder of the vast silk business of that town, based on his patented silk and velvet looms. Explaining to a correspondent of the *Times* his reasons for subscribing $10,000 to the Fair Trade League, he said:

"A few years ago my looms were idle, while London was flooded with German velvets. I was undersold. For two years I paid my workpeople out of capital. In that time, however, I had considerably reduced their number, and their wages were not nearly as much as they are now. At the time I speak of we were also beaten not only in velvets, but the Swiss spinners were even sending their yarns into Bradford. Supposing that I had been a weak capitalist, and this German confederation had overthrown me—what then? The free trade theory, that if one trade cannot supply laborers another can, would have been put to a severe test. Could the worsted trade of Bradford have employed my thousands of workpeople? No, sir. Could it do so then or now, or is there any other trade that could? None. In a recent lecture I gave this as an illustration to show how necessary it is to see how the laboring classes are to be employed before you allow one industry after another to be destroyed by foreign competition. Let us look a little further. I pay £1,000 a year poor rate. What if I had closed my mills and ceased to pay that or anything else? And, supposing, instead of paying £1,000 a week and more—£52,000 a year and more—out of my own pocket to support my workers, the poor rate had been charged with it, what then? I think some of the free trade ratepayers would have found out the practical effects of unrestricted foreign competition. What pen or tongue can say what my workpeople would have suffered? And for whose benefit? Certainly not for mine, for had I been a weak capitalist and gone to the wall, I should have been one of the chief sufferers. For whose good, then, would all the misery have been suffered? For the good of the foreign capitalist and the foreign workman, in order that luxury might be clothed at a farthing or so a yard less! That is free trade!

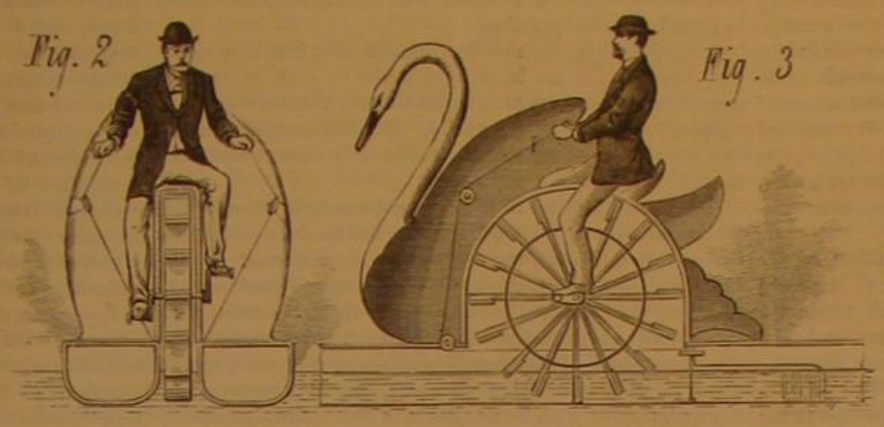
"In the early days of free trade there were no steamers, no means of rapid transit. We could not be inundated with foreign goods—even corn came in slowly. We were masters of the world in regard to manufactures. To-day we are not; to-day we have free trade in all its simplicity, and the result is disaster, the bankruptcy of the manufacturer, the ruin of the farmer, and the destruction of independent and profitable labor."

Nevada Monumental Granite.

The beautiful stone contributed by the State of Nevada to the Washington Monument has arrived in that city, and is described by the *Republican* as an object of great interest. It is a pure specimen of native granite, and is elaborately inscribed. The letters are of solid silver, and about as thick as a silver dollar, some six inches in height, and of proportionate width. They are so neatly fitted into the solid granite that the joint is almost invisible. Above the word "Nevada" is deeply cut in the granite the motto of the State, "All for Our Country," and below the date, 1881. The figures of the date are plated with gold. The granite composing it is the hardest ever seen. That part which is polished is almost blue in color, while the remainder presents a somewhat gray appearance. It is the most expensive stone contributed by any State so far.

The Survey of the Northwest.

Mention has been made in this paper of the projected scientific survey of the country tributary to the Northern Pacific Railway and the Oregon and Railway Navigation Company's lines, under Professor Raphael Pumpelly. The *Evening Post* announces that the work, which will be organized for a term of years, contemplates mapping the country "on a published scale of four miles to the inch," in order to show the geological structure, the distribution of minerals, of the different varieties of soils, of plants and animals, and the climatic conditions. For the thoroughness and high scientific quality of it the director's name is a guaranty, but he has also associated with him a number of trained men from the United States Geological Survey, including Mr. Wilson, the able topographer of the Fortieth Parallel Survey. The classification of the lands of the railroad companies according to their fertility and their mineral and timber resources will, of course, furnish a rational guide to the extension of branches, and will have a wholesome effect in turning immigration into remunerative channels. The bulletin which the survey contemplates publishing will thus be eagerly consulted. Meantime, the Signal Service will welcome the new meteorological stations to be established in the pre-eminently weather-breeding sections of the continent. In every way the country at large will profit by this nominally private enterprise, which anticipates the national exploration of the great northwest territory.



SECTIONAL VIEWS OF VELOCIPEDE BOAT.

VELOCIPEDE BOAT IN THE PUBLIC GARDEN, BOSTON.

We give engravings of a velocipede boat of novel design in daily use in the Public Garden, Boston, Mass. The boat is made after plans by Captain Thompson, and is not only an ornament to the lake, but is one of the easiest and most comfortable of small craft.

The boat is double, the two hulls being connected together by curved bars at the bow and stern. The paddlewheel plies between the hulls, and is located abaft the middle of the boat. It is worked after the manner of a velocipede wheel, and is covered by a metallic sheathing, which in turn is covered by a beautifully modeled swan in hammered copper.

The man working the wheel sits between the wings of the swan, and controls the rudder by tiller ropes extending upward over pulleys inside the swan, as show in Fig. 3. The hulls are of galvanized iron, and measure about twenty-five feet in length.

Fig. 1.—VELOCIPEDE BOAT IN THE PUBLIC GARDEN, BOSTON.

The boat does not attain a great speed, but it is free from rocking and tipping, and is a great favorite. A number of them are in use in Boston.

Another New Comet.

The Smithsonian Institution has received from the Astronomer Royal of Greenwich the announcement of the discovery, by Denning, on October 4, at 15 hours, of a bright comet in Leo, in 9 hours 22 minutes right ascension, 16° of north declination, with a daily motion of 30 minutes east.

This is the fifth new comet of this year, Encke's being an old acquaintance. All but comet A, 1881, are, we understand, still telescopically visible. Four of the six appeared in the constellation Auriga. It is quite unusual for so many of these erratic wanderers to be on view at once.

Some Practical Hints on Nickel Plating.

BY FR. LAHTMANN.

Nickel plates and sheet nickel are now generally made by the manufacturers of nickel ware. These may be used in the production of a solution which is particularly well adapted for nickel plating. To this end the nickel is placed on a perforated board in a saturated solution of ammonium chloride (sal ammoniac), and the metal brought in connection with the positive pole of a strong battery. By the influence of the electric current the metal gradually becomes dissolved, and a double salt is formed (nickel ammonium chloride), which settles on the bottom of the vessel, while, at the same time, the metal is kept continually in contact with the ammonium chloride.

If the nickel has previously been weighed, the amount of the metal which has become dissolved can at any time be determined by weighing the as yet uncombined nickel. In order to nickelize with this solution, a plate of pure nickel is suspended in the fluid, and it is connected with the positive pole of the battery, while the metallic body which is to be coated, and which must, of course, be well cleaned, is connected, after it has been immersed, with the negative pole. The nickel is precipitated from the solution as a bright coat, whose thickness depends upon the length of time during which the current is acting upon it, and also upon the strength of the latter.

In order to operate directly with the nickel sulphate, it is necessary to have a salt entirely acid free, which may readily be prepared by adding a small quantity of sodium hydrate (caustic soda) to the solution of the commercial salt, after having first removed the copper in the manner which will presently be described. When the acid is neutralized, an apple-green precipitate of nickel hydrate is formed, which is boiled for some time and then filtered. The solution is now perfectly neutral.

To remove the copper from the nickel salt, the latter is first dissolved in water and acidulated by a few drops of sulphuric acid (commercial nickel sulphate is generally acid), then a current of hydrogen sulphide gas, which is prepared by pouring sulphuric acid over iron sulphide in a flask, is passed through the solution.

The copper and other metals which are likely to be present are thrown down in the form of a black precipitate. When the odor of the gas is distinctly recognized its passage is stopped, and the solution heated to expel the last traces of the hydrogen sulphide. It is then heated to boiling in a porcelain vessel with the addition of some metallic nickel. By this means the free acid is neutralized, and on evaporating to crystallization there remains a salt sufficiently pure for nickel plating.

The articles which are to be plated are suspended in the solution which we have just described, and they are connected with the positive pole. A nickel plate, which also dips into the liquid, is connected with the negative pole; and from time to time the liberated acid is neutralized by the addition of a slight quantity of ammonium hydrate. It is better still, for practical results, to spread a layer of nickel oxide over the bottom of the vessel in which the nickelizing is being carried on. This will dissolve in the free acid, and the solution will therefore remain neutral and of uniform strength.

The nickel oxide is prepared by completely saturating a solution of nickel sulphate with sodium hydrate (caustic soda), washing the precipitate, and then drying it. The nickel oxide thus formed is a heavy powder of an apple-green color, and may be either spread over the bottom of the vessel, or else it can be placed in a linen bag and suspended in the liquid. If a solution of nickel sulphate, acidified with sulphuric acid, is poured into a saturated solution of ammonium sulphate, crystals will separate out, consisting of the double salt of nickel ammonium sulphate. The crystals are washed with cold water, dissolved in hot water, and then the solution is completely neutralized with ammonium hydrate. It is then allowed to stand for several days at a temperature of 20° to 25°, until no more crystals separate out. It is also of importance that the liquid be maintained at this temperature during the nickelizing, for otherwise the nickel will not adhere firmly to the metal.

During the operation of plating a sheet of nickel, connected with the positive pole of the battery, is suspended in the solution. According as the nickel becomes separated from the solution the sheet dissolves, and thus the solution maintains its original strength. Plates of absolutely pure nickel are at present quite expensive, in consequence of the

very high temperature which is required for their fusing and casting. By the addition of one five-thousandth part of phosphorus its point of fusion may be considerably lowered. As the phosphorus is not objectionable in nickelizing, the plates are generally made of metal containing phosphorus, and they are used to the best advantage in rather thin sheets, for, the larger the surface of the nickel plate, the less will be the strength of the current required; and when the pieces to be plated are not large, as will occur in the majority of cases, two or three Bunsen elements will be sufficient.

In addition to the above methods for nickel plating others have been proposed, which also give good results, but which require more expensive preparations than those previously mentioned; thus, for instance, the double salt of nickel potassium cyanide and solutions of nickel nitrate have been proposed. On account of the vapors which escape from the cyanide solutions, although only in small quantities, they are particularly objectionable, and therefore the employment of cyanide preparations, on account of their poisonous properties, should be avoided whenever it is possible to do so. The nickel nitrate gives a beautiful and durable coat of nickel. The solution is most effective when it is composed of 4 parts of crystallized nickel nitrate dissolved in 150 parts of water, to which 4 parts of ammonium hydrate are added, and then 50 parts of the acid sulphite of sodium are dissolved in the above solution.

The acid sodium sulphite is prepared by heating copper with sulphuric acid in a retort, the gas produced is passed through a small quantity of water, which will retain the copper which has been mechanically carried over, and then the gas (sulphurous acid) is dissolved in water until the liquid smells distinctly of burning sulphur. The solution which has thus been obtained is divided into two portions; one part is saturated with sodium carbonate as long as effervescence takes place, the other half of the acid is then added, and in this manner the bisulphite of sodium is produced. This must be employed as it is, because it is impossible to crystallize the salt by evaporation, for in so doing one half of the acid would escape and the mono-sulphite of sodium remain behind.

For nickel plating of the finest kind, such as is produced in American factories, a solution is prepared from the nickel nitrate and acid sodium sulphite. It sometimes happens that the nickel will strip or peel off from the metals on which it has been deposited. It is said that this objection can be overcome by placing the dried plated objects into a bath of oil and heating them up to 250°-270°.

According to Weston, a plating of great beauty and durability is obtained by mixing a solution composed of 5 parts nickel chloride and 2 parts boracic acid with one made up of 2 parts nickel sulphate and 1 part boracic acid, and then adding, while continually stirring, sodium hydrate (caustic soda) until the precipitate is redissolved.

For the nickelizing of iron or steel, it is best to first coat the objects to be plated with a thin film of copper, which is readily accomplished by dipping the material into a dilute solution of copper sulphate.—*Neueste Erfindungen und Erfahrungen*, viii., p. 411.

AMERICAN INDUSTRIES.—No. 77.

THE MANUFACTURE OF STEAM, WATER, AND OIL WELL FITTINGS.

It is only within comparatively recent years that it has ceased to be necessary for every builder of steam engines or boilers to make his own valves, pipe connections, and much other work of a similar character. The manufacture of these articles is now a separate industry. The expense formerly attending the production of these articles in connection with legitimate engine work, was necessarily very great, and no better evidence of this is needed than the success of the great manufactories of this class of goods, which are perfectly adapted to the purpose and provided with the most improved machinery and tools.

The views given on our title page illustrate the extensive establishment of the Jarecki Manufacturing Company, located at Erie, Pa., who have been very successful in building up and extending its trade.

The building was established about twenty years ago, without capital, and with apparatus consisting of only two hand-lathes of the crudest make, and a small furnace for melting brass. We cannot trace the developments of this concern from this small beginning to its present extensive proportions, although it would undoubtedly prove very interesting. The practical mechanical knowledge, industry, and sound business principles of the brothers, Henry and Charles Jarecki—the founders of the business—were elements that contributed most in placing this industry high among the manufacturing interests of the country.

Among the views on the first page is a sketch showing the general appearance of the buildings. They consist of several handsome structures having a frontage of 330 feet. The main building has an elevation of three stories above the basement, and covers an area 175x60 feet, and there is a wing attached to the rear which is 80x40 feet. To the right is the galvanizing shop, 70x40 feet, and the extension on the left is the malleable iron foundry, inclosing a space 80x150 feet. Attached to this at the rear and opening into it is the gray iron foundry, 60x100 feet. The annealing room, 50x80 feet, is back of this, and further to the right is the core shop, 50x160 feet. Situated between this and the main building is the rattler room, 40x100 feet. The buildings are all of brick, and substantial and strong in construction.

Entering the works at the west end, we pass through the office and into the main machine room (shown in the engraving), 175 feet long by 60 wide. All the available space is filled with lathes, planers, milling machines, and a great deal of other machinery employed for special work. Among the most perfect machines are those for tapping malleable iron fittings. They can be operated by an attendant having very little skill. For example, a T-fitting is placed in a chuck, which is then moved into position for the taps to enter the openings of the fitting. The machine is then put in motion, and while the taps are doing their work another Tee is put into a second chuck. As soon as the threading of the first fitting is accomplished the machine reverses itself, and when the taps have been carried back the proper distance it comes to a stop. The chuck holding the tapped fitting is then swung out, and the second one substituted. The method of procedure now is but a repetition of that already described, and the attendant has little else to do than to keep the chucks supplied with blank fittings.

In pipe fittings, such as Tees and elbows, it is very essential that the branches be at right angles to each other. To secure this result is next to impossible by the old method of tapping each opening separately. But the machines used in this establishment are so perfect that only correct work can be done on them.

The variety of sizes of the different patterns of malleable fittings made here is almost endless, and in their production due consideration is always given to the matter of adaptability and cost. Fittings for gas connections require only moderate strength, and are of a much lighter pattern than those designed for use as steam or water connections. For the convenience of the trade, manufacturers of this class of goods have a list, or chart, on which each fitting represented is supplemented with its number and size. Fittings sold by weight are numbered up to 671, and of these the greater portion are of two styles—the plain pattern for gas, and the beaded for steam or water. There are, besides, several other patterns of fittings, not sold by weight, which have no place on the chart.

With the larger and more massive machines, designed for tapping fittings varying in size up to three inches, the threading is effected with the same ease and smoothness of motion as in the case of the smallest machines. Fittings with openings varying in size present no difficulties, and a Tee with branches, each for a different size of pipe, is disposed of exactly as when the openings are all alike, and the tapping of one opening left-handed and the other right is just as easily accomplished.

Among machines designed for special work are those for making unions, flange unions, bushings, and a variety of other pipe connections, and the large upright machines for tapping gray iron fittings of the larger sizes up to six inches are especially noteworthy. Here the opening of the fitting is first reamed to the proper size, the reamer is then replaced with what is known as an expansion tap. The purpose of this tool is to do away with the necessity of running back the tap after the threading is completed. This is accomplished by shifting a cam arrangement whereby the cutters are drawn into the body of the tap, which is then removed without interfering at all with the motion of the machine, rendering stoppages unnecessary either for the removal or adjustment of reamer or tap. Other mechanism is employed for threading the still larger fittings, which include the size for 12 inch pipe connections. From a 12 inch Tee, which has a weight of about 300 pounds, down the range of sizes to the one-eighth inch elbows and Tees, of which eighteen or twenty weigh not more than one pound, the number of pieces of even the straight sizes of fittings is astonishing.

To one unfamiliar with the appliances in use in the production of petroleum in the Pennsylvania oil fields the purpose of many of the implements made in this establishment would be a matter of considerable conjecture. This company was one of the first to make a specialty of the manufacture of the class of goods used in the petroleum industry. They have, in fact, grown up with its development, and have never failed to keep pace with the requirements and constantly increasing demands of the oil producers. Most important in this line of goods are the oil well pumps. The pump chambers first in use were tubes of drawn brass, but in the matter of durability and cost they did not prove entirely satisfactory. The substitution of cast iron tubes for the purpose gave results most favorable in all respects, and now for many years this material has been used in their manufacture at this establishment.

The machinery for the production of these pumps consists of three upright boring machines, extending from the basement upward into the machine room, each with capacity for boring six pump chambers. Each machine is provided with six hollow spindles, into which are placed the solid cast iron cylinders, 5 feet long and 3 inches in diameter. By the action of the machine the spindles containing the cylinders are revolved, and the boring is done with drills which work upward to allow clearances for the chips. Afterwards a reamer is used to make the bore exact and true, and the now hollow cylinders are then transferred to a horizontal polishing machine, provided with plungers having at the ends fork-shaped attachments, secured to the tines of which are lead pieces, semi-cylindrical in form. As the pump chambers revolve at a high rate of speed, the plungers travel forward and back through the whole length of the bore, and by the aid of emery and oil the tubes are finished to a mathematical exactness in size and a most beautiful polish secured. These last mentioned machines, and many of the other specialties already referred to, were designed and built at this establishment.

A steam engine for oil well drilling is another production of this department. Its points of superiority are the perfection of its balance valve and the link-motion attachment, by means of which the engine can be instantly reversed, however high the rate of speed may be. For engines for deep well drilling this link motion is indispensable. Another useful and novel contrivance is the water packer, designed in part for use in deep wells to shut off water veins in the rock, but more particularly to confine the gas in the wells so that the accumulating pressure will force the oil up through the tubing and make a flowing well where otherwise the use of a pump would be necessary. A considerable portion of the machinery here is also employed in perfecting in its various parts the Jarecki adjustable pipe tongs, shown in the engraving. The superiority of these tongs has been well established. Each pair serves the purpose of six sizes of common tongs, and it takes but a moment to adjust them to any desired size. The steel bar or grip is reversible, the end that is made concave being intended for use in cases where injury to the surface is to be avoided. With the pointed end properly adjusted the tong is valuable as a wrench for square or other shaped nuts.

Another of the products of this department is a great variety of iron body globe and angle valves, safety and back-pressure valves, and gate valves, including all the sizes for which a demand exists, and varying in weight from ten pounds to one thousand pounds.

Equal in area to the main machine room, and in the story above it, is the brass finishing department, pleasantly situated and with windows on every side, affording ample light and ventilation. Here are made brass goods of almost every description, the supplies for steam purposes being most largely represented. With the relatively low prices prevalent for goods of this class they can be profitably manufactured only by the use of the most improved machinery and tools. Brass valves of any one size are here taken in work in lots of usually not less than one thousand pieces at a time, and many of the parts in the process of finishing pass through a succession of lathes before being completed. The brass valves and cocks include the sizes from one-eighth of an inch to four inch, and are of various patterns. For ordinary uses the bodies are left in the rough, just as they come from the moulds, except in such parts as can be easily finished. But of valves for steam purposes there is a great diversity of style and finish. The nickel-plated radiator valve, mounted with rosewood wheels, and highly polished over its entire surface, is an example of perfection of workmanship and elegance of finish. The smaller lathes are kept busy on such brass work as air cocks and bibbs, cylinder and gauge cocks, and everything in that line used for either steam, gas, water, or oil.

Of materials made in this department for oil well purposes, the ball valves for use in the pump chambers already referred to are among the most important. Oil wells as at present drilled vary in depth from 1,700 to 2,000 feet, and experiments with valves of almost every description for pumping these wells have established the superiority of this ball valve, both in effectiveness and durability. The upper or plunger valve is among the views given. With the exception of the packing and seat, it is made entirely of brass, the ball being of very hard brass; the seat on which the ball rests is of hard steel, and is held in place by the valve crown or top, which clamps it to the body of the valve. For packing, cup-shaped leathers are used; they are arranged to admit of expansion under pressure to insure their fitting the pump chamber closely until worn too thin for further use.

The pressure to which the valves in actual use are subjected averages 1,000 pounds to the square inch. Under such conditions they are naturally rapidly worn out, but as all the like parts of the valves are made uniform, any worn or damaged part is easily replaced. The lower or standing valve differs from the plunger only in the arrangement of the packing, for which leather rings are used instead of cup-shaped leathers. The manufacture of these valves, under letters patent, has been carried on by this company for nearly twelve years, and during that time much progress has been made in perfecting machinery for the purpose. The finishing of the valve balls by the methods originally employed was an operation demanding a degree of skill in its accomplishment which few possessed, but with the mechanism now in use the process is a very simple one.

The deep well pumps include other sizes than those in use for oil wells. From the very small pump to be used in connection with one inch pipe they are made of sizes increasing regularly up to the monster pump for six inch pipe. The chambers for the larger sizes are heavy drawn brass tubes. These pumps are in use in all parts of the country, and many of the larger sizes are to be found in the Colorado mining districts, as well as at some of the principal breweries in New York city, where they are used in connection with artesian wells.

Another product of the brass department, although no brass is used in its production, is the Jarecki screw plate, shown in the engravings, the purpose of which is to thread and to cut off pipe. It is a tool capable of adjustment to different sizes of pipe. The cam plate and the face of the stock are stamped with corresponding figures, and to set the dies to any desired size the cam plate is moved until the figures corresponding to the size are in line, when the thumb nut is screwed down and the plate is ready for use. After a thread has been cut the stock can be instantly removed by

shifting the cam plate so as to draw the dies back from the pipe. An important feature of this tool is that when a number of pieces of the same size of pipe are to be threaded there is a stud bolt which, after the dies have been properly set, can be adjusted to limit the throw of the cam plate to that size, and thus the trouble of resetting after each operation is avoided. The plates are also provided with an effective appliance for cutting off pipe. The working parts are all made after a uniform standard, and can easily be duplicated. Five sizes are made, which are numbered from 1 to 5, and their combined range includes the various sizes of pipe from one quarter inch to six inches.

The floor above the brass finishing department is occupied in part by the pattern and carpenter shops, which are provided with everything necessary to that branch, and most of the remaining space serves as a place for grinding castings, for which purpose a large number of emery wheels are in operation. The drill presses here, and the machines for punching, stamping, and shearing, are for the manufacture of boiler flue cleaners, for which cast steel is used to make the springs and scraper pieces, the stems or stocks being of malleable iron. This flue cleaner meets with a large sale, and has proved very efficient and satisfactory.

Going down from this floor on the elevator there are found the varied products of manufacture stored, ready to be put on the market. The store room is 175 x 60 feet, and is provided with numberless tiers of bins for the thousands of sizes of fittings of the various kinds, and with closed compartments in which the brass goods are kept to be free from dust and dirt.

The motive power for the works is furnished by a 125 horse power engine in a room adjoining the main building, and two large boilers supply the steam. The blacksmith shop has eight forges, a power hammer, and other necessary appointments. Adjoining this is the brass moulding shop, spacious and well ventilated, provided with five melting furnaces in which fifteen to twenty heats are made daily. The operation of melting and pouring is shown in the engraving.

The malleable iron foundry presents a scene of bustle and activity. Here bench or snap flask moulding is the process mainly in use, which differs from the ordinary moulding in not requiring a separate flask for each mould. The snap flasks are frames of wood, hinged at the corners, to admit of being removed from the completed moulds, which are then transferred to the foundry floor, and, if necessary, placed one upon the other to a height of three or four moulds. When piled up in this way the top moulds are poured first, and when the metal has had time to "set," they are removed, and those next below are ready to receive the melted metal. Only brass patterns are used here, which are arranged in forms technically called gates, each gate being made up of as many pieces as the size of the articles and dimensions of the flask will admit. The iron for this department is melted in an air furnace, and without artificial blast, a chimney 120 feet high affording the necessary draught. At one end of the furnace is the fire grate, so situated that the flames are carried over the iron to be melted. Thus all the different grades of iron in the furnace are fused at one time, and the melted metal need not be removed until it has become thoroughly mixed and is of a uniform temperature of the degree desired—conditions necessary for an iron suitable for heavy malleable castings. Charcoal iron is almost exclusively employed for malleable work. The castings, as they come from the moulds, have a white luster and are very brittle and hard. The view given of this department shows the men in the act of receiving the melted metal from the furnace and pouring it into the moulds. In an adjoining smaller room are made malleable castings from cupola melted iron. These are only the smaller and lighter pieces for which this process of melting has been found suitable.

In the spacious gray iron foundry near at hand are made the castings for the various sizes of iron for body valves and cocks, and also for the gray iron fittings, of which the multiplicity of sizes is almost as varied as in the case of the malleable iron fittings. For the lighter castings the breech-moulding process is used.

An interior view of the annealing room is given, showing the annealing furnaces, which occupy the entire length of the room on one side. As the castings come from the moulds they are first cleaned of sand by the tumbling process and are then brought to this department, where they are packed in iron pots, with alternate layers of iron scale. As fast as the pots are filled the tops are covered over with a layer of clay and then placed in the ovens. When an oven is full the opening is walled up with bricks, which are then plastered over with clay. Heat is now applied, gradually increasing in degree until the castings become red hot, in which condition they are kept for a length of time, varying from six to eight days, according as the castings are light or heavy. After the pots have been drawn out from the ovens and are sufficiently cooled the castings are dumped. In the process of extracting the carbon the castings have also been considerably changed in appearance, being now covered with beautifully colored scales of varying hues, from straw color to dark blue, which, if not quickly removed, would expose the castings to rapid oxidation.

Situated convenient to the foundries is the large core shop, where more than fifty men and boys are employed to supply the various moulding departments with cores, in quantities not less than twenty-five thousand every day. The material, as prepared for making the cores, consists of a mixture of sand with flour, rosin, molasses, sour beer, or such other materials as may be required. The cores are formed in metal core boxes, or moulds, from which they are transferred to iron plates and carried to the ovens to be baked. Much of the work here requires a practiced and experienced hand for its accomplishment, while for the more ordinary forms the rapidity with which they can be made depends entirely on the dexterity of the operator.

In a building separate from the others and located near the iron foundries, are the tumblers or rattle barrels, ten in number, which receive the iron castings as they come from the moulds and the annealing pots. They are operated by means of a shaft which receives its motion from a special engine provided for the purpose.

On the premises is a natural gas well, drilled to a depth of 700 feet, which has been in operation for the last ten years. During the first year after its completion the supply of gas was sufficiently abundant to be used as fuel for generating steam, besides furnishing light for the different shops. But after that time the volume of gas diminished considerably, and from then on the yield, though steadily maintained, was no more than adequate to the need for lighting purposes.

The department last to be reached is the galvanizing shop. The variety of malleable and gray iron castings and fittings here in course of preparation to be galvanized includes a large amount of castings for clothes wringers and washing machines. Galvanizing is not a complex process, but the experience gained by long practice and careful observation is a necessary condition to perfect work. As the castings come from the acid baths they are immersed into melted zinc, and when thoroughly coated with that material are plunged into water and held there a moment, which gives them a frosted and silvery appearance. The operation of tinning is also performed here, which differs but little from the galvanizing process.

The extensive trade of this concern in the oil regions of Pennsylvania and the adjacent States has necessitated the establishing there of branch stores at the various business centers. At present the number of the stores is eight, but every new development of territory is closely followed in order that additional branches may be provided wherever the indications seem to favor such a step.

In the factory at Erie employment is given to about four hundred men. The uniform excellence in quality and workmanship of the diversified products of manufacture has secured a market for them in almost every State in the Union, and in the Dominion of Canada.

Characteristic Incidents of the Michigan Fire.

Fires had been burning in Sanilac, Huron, and Tuscola counties, but no one apprehended any danger. Farmers had set fire to slashings to clear the ground for fall wheat, but this happens every fall, and the fact that not a drop of water had fallen in from fifty to seventy days was not considered by those who saw the smoke clouds and replied that there was no danger. There was danger. Behind that pall of smoke was a greater enemy than an earthquake, and it had a tornado at its back and two hundred miles of forest in the front. From noon until two o'clock a strange terror held the people in its grip; then all of a sudden the heavens took fire, or so it seemed to hundreds. In some localities it came with the sound of thunder. In others it was preceded by a terrible roaring as if a tidal wave were sweeping over the country. Almost at the same minute the flames appeared in every spot over a district of country thirty miles broad by one hundred in length.

At Richmondville, ten miles above Sanilac, one hundred and fifty people had comfortable homes, stacks of hay and grain, teams, cows, pigs, sheep, and no fear of the fire which they knew was burning a mile away. At two o'clock the flames rushed out of the woods, leaped the fences, ran across the bare fields, and swallowed every house but two, and roasted alive a dozen people. It is hardly forty rods to the beach of the lake, and yet many people had no time to reach the water. Others reached it with clothing on fire and faces and hands blistered. The houses did not burn singly, but one billow of flame seized all at once and reduced them to nothing in ten minutes.

I saw many and many a spot where the billows of fire jumped a clean half mile out of the forest to clutch house or barn. The Thornton family were wiped out with the exception of a boy. Thornton had hitched up his team to drive the family to a place of safety, but when he saw that they were all surrounded by the flames he unhitched the horses in despair. Before they could be unharnessed they bolted in different directions, and the old man became so confused that he ran directly toward a big slashing, which was than a perfect mass of flame, and dropped and died with his head toward it.

Meantime the mother and children had taken refuge in the root house. This was a structure mostly sunk in the ground and the roof well covered with earth. Here they were all right for a time, but when the father failed to join them one of the sons went out to see what caused the delay. He was hardly out of the place before the door through which he had passed was in flames. In this emergency he ran to a dry creek, and by lying on his face and keeping his mouth to the ground he lived through it.

I talked with a woman who lived neighbor to the Thorntons, and who escaped by fleeing to a field of plowed ground. This was only a few rods from the root house, and she said it was fully an hour before the screams and shrieks and groans from the people inside grew quiet in death. One by one they were suffocated by heat and smoke, and their bodies presented a most horrible appearance. To one riding through the district it seems miraculous that a single soul escaped. The fire swept through the green trees the same as the dry. It ran through fields of corn at the rate of twenty miles an hour, and fields of clover were swept as bare as a floor. Dark and gloomy swamps, filled with pools of stagnant water, and the home for years of wildcats, bears, and snakes, were struck and shriveled and burned almost in a flash. Over the parched meadows the flames ran faster than a horse could galop. Horses did galop before it, but were overtaken and left roasting on the ground. It seemed as if every hope and avenue of escape were cut off, and yet hundreds of lives were spared. People spent ten to twenty hours in ditches and ponds, or in fields under wet blankets, having their hair singed, their limbs blistered, and their clothing burned off piece by piece.

In dozens of cases the first flames spared houses and barns, but after seeming to have passed on for miles, suddenly circled back and made a clean sweep of everything. Unless one rides over the burnt district he cannot believe the eccentricities of a forest fire. In the great swamp, between Sanilac and Sandusky, it burned everything to the roots for a mile in breadth. Then it left patches from ten feet to ten rods wide. Then again it struck in and burned lanes hardly twenty feet wide, leaving half a mile of fuel on either side. In the timber it seemed to strike the green trees harder than the dry ones. It was like a great serpent making its way across the country. It would run within three feet of a wheat stack, and then glide away to lick up a house. It would burn a stack and spare a barn ten feet off.

People felt the heat while the fire was yet miles away. It withered the leaves of trees standing two miles from the path of the fiery serpent. The very earth took fire in hundreds of places, and blazed up as if the fire were feasting on cordwood. The stoutest log buildings stood up only a few minutes. The fire seemed to catch them at every corner at once, and after a whirl and a roar nothing would be left. Seven miles off the beach, at Forester, sailors found the heat uncomfortable. Where some houses and barns were burned we could not find even a blackened stick. Every log, beam, and board was reduced to fine ashes.

Seven miles back from the lake at Forester a farmer gathered up fifteen persons in his wagon and started for the beach. The fire was close behind them as they started—so close that the dresses of some of the women and children were on fire from the sparks. It was seven miles of up hill and down, with corduroy, ruts, and roots, and the horses needed no whip to urge them into a mad run. As the wagon started the tire of a hind wheel rolled off. They could not stop for it, and yet, even on a good road the wheel would have crushed down in going twenty rods without it.

It is an actual fact that the horses pushed over that seven miles of rough road at a wild run, and the wheel stood firm. A delay of five minutes at any point of the road would have given fifteen more victims to the flames which followed on behind. I saw the wagon at the lake, and I saw the tire seven miles away on the roadside.

The people who sought the beach had still to endure much of the heat and all of the smoke. Wading up to their shoulders, they were safe from the flames, but sparks and cinders fell like a snow storm and the smoke was suffocating. The birds not caught in the woods were carried out to sea and drowned, and the waves have washed thousands of them ashore. Squirrels, rabbits, and such small animals stood no show at all, but deer and bear sought the beach and the company of human beings. In one case a man leaped from a bluff into the lake and found himself close behind a large bear. They remained in company under the bank nearly all night, and the bear seemed as humble as a dog. In another instance two of the animals came out of the forest and stood close to a well from which a farmer was drawing water to dash over his house, and they were with him for two hours before they deemed it prudent to jog along. Deer came out and sought the companionship of cattle and horses, and paid no attention to persons rushing past them.—*Detroit Free Press.*

Reed Bird Shooting in Delaware.

As they go southward in the fall, our favorite meadow singers, the bobolinks, take to the marshes and become reed birds, much sought after by sportsmen and pot hunters. At Chester, Delaware, the headquarters of the bird shooters of the State, there are forty professional "pushers." The shooting begins the first of September. The Philadelphia *Times* makes a brief estimate of the results of a month's shooting. At Chester, at the Lazaretto, and the two hundred club houses that line both banks of the Delaware from League Island to Marcus Hook, there will be at least nine hundred shooters daily. At the former two places 2,000 birds daily—taking the scores of those who push themselves and of the professional shooters—will be killed. Eight hundred gunners daily from the private club houses is but a fair count, and, giving them each a score of 10 birds daily, the total will be 10,000 birds killed every day in the month of September, an aggregate of 300,000 scored at the above places alone. This is but a meager approximation of the grand total, probably ranging over 1,000,000 when the marshes from Bombay Hook to Bordentown are included in the estimate."

The Non-Condensing vs. the Condensing Engine.

Experiments made with a Corliss condensing engine at a factory in Mulhouse, Germany, in 1878, and others made with a Corliss engine of the non-condensing type at the fifth Cincinnati Exhibition, in 1874, have been compared and ably discussed by Chief Engineer Isherwood, of the U. S. Navy, for the purpose of determining the boiler pressure at which the non-condensing becomes equal in economy to the condensing engine. His paper is given in the *Franklin Journal*. The well known opposition of Mr. Isherwood to high measures of expansion in the marine engine need not affect the mind of the reader, as Mr. Isherwood considers it abundantly proved that no economic gain results from carrying expansion beyond the measures easily obtainable in non-condensing engines, when using steam at 70 pounds boiler pressure and upward. No motive, therefore, can fairly be imputed to him for departing from his usual accuracy and thoroughness in searching for the truth. It is assumed that, since the back pressure in good examples of both types of engines may be taken as constant at about 3½ pounds per square inch for the condensing and 16 pounds for the non-condensing engine, and the feed water at 100° F. for the former and 200° F. for the latter, there is an initial steam pressure at which the two types will be equal in economic effect.

To offset the less back pressure and the greater measure of expansion in the condensing engine we have the saving of the power required to work the air pump and the higher temperature of the feed water in the non-condensing engine; but the question of the boiler pressure at which the two types become equal must be determined by experiment for each new set of conditions, principally because of the variation of cylinder condensation, which has been shown to be, in former experiments with this size of condensing engine, cylinder, and measure of expansion, as much as 29 per centum of all the steam evaporated in the boiler. This amount is varied by the relative size of the cylinder, the grade of expansion, which affects the extremes of the temperature of the steam during a double stroke of the piston, the character of the metal of the cylinder as a conductor of heat, and the piston speed, with any given initial pressure.

The engines which are compared are not of the same size, nor were they worked at the same piston speed.

The non-condensing engine had a cylinder 16⅛ inches diameter, and was worked at approximately 240 feet per minute piston speed. The condensing engine had a cylinder 24 inches diameter, and a piston speed of about 200 feet per minute. They were of the same length, 4 feet. The loss by cylinder condensation would have been something greater in the condensing cylinder if it had been as small as the other; and, on the other hand, the loss from this cause would have been greater in the non-condensing cylinder if its piston had moved at the slower rate, so that their differences in conditions may be considered as neutralizing each other as regards this loss. It is seldom, however, that conditions as nearly alike are subjects of careful tests for economic results. The horse power is measured by the number of Fahr. units of heat per horse power per hour. The cost of the heat, being a question of boiler efficiency, is ignored.

In his remarks after the discussion of the cost of the total horse power, the author says:

"The net horse power, representing the portion of the total horse power developed by the engine that was commercially useful, was obtained for the consumption of 31,707·0685 Fahrenheit units of heat per hour with the condensing engine, and of 32,091·6077 Fahrenheit units with the non-condensing engine; and if a very small allowance be made in favor of the latter for the greater economic vaporization in its boiler per pound of fuel, owing to the slower rate of combustion, the cost of the net horse power in both cases will be equal; showing that a non-condensing engine with an unjacketed cylinder of the experimental dimensions, using saturated steam of 70½ pounds boiler pressure per square inch above the atmosphere, with an expansion of nearly 4⅜ times, gave the same commercial result—that is to say, the same net power for the same quantity of fuel per hour—as a condensing engine with a 2¼ times more capacious unjacketed cylinder using saturated steam of 66½ pounds boiler pressure per square inch above the atmosphere with an expansion of nearly 8 times. Hence, under the experimental conditions, no economy would result from the employment of a condenser and air pump, when the boiler pressure was not less than 70½ pounds per square inch above the atmosphere. If the engine works with a variable load, this must be taken for the lower limit of pressure—not the average pressure—giving equality of economic effect.

"The foregoing results are true for only the precise experimental conditions, and they will be modified by any of the causes which diminish cylinder condensation, as, for example, steam-jacketing the cylinders, superheating the steam, employing larger cylinders, etc.

"It is probable," the author says, "that with boiler pressure of from 95 to 100 pounds per square inch above the atmosphere the non-condensing engine would give the net power with fully as much economy of fuel as the condensing engine using the same steam pressure with the measure of expansion found to produce the greatest economy, even with steam-jacketing, steam-superheating, and cylinders of the largest dimensions in both cases."

This is certainly a matter of great importance in marine economy. The omission of the air pump and its appendages, and the reduction of the size of the engine, thereby relieving the vessel of a permanent deadweight, are worthy of our best efforts. The greater weight of boiler, if any, of the old marine types, rendered necessary by the higher steam pressure, may perhaps balance the mere weight of the omitted air pump itself, while the surface condenser is still needed to supply distilled water for the boiler. In making up an estimate of the economies, the room occupied and the weight carried, not only of the engine, condenser, and pumps, but also of the boilers, the fuel, and the water, in boilers and condensers are to be considered. It is known, however, that in using steam of high pressure, even in heavy condensing engines using high measures of expansion and great cylinder condensation, substantial progress in economy has been realized, and it may be that a still further advance may be made by improving the boiler and reducing the amount of water and fuel carried, as well as by omitting the air pump of the marine engine.

Effects of Lightning on Trees Near a Telegraph Wire.

Some instructive facts in this connection have been brought to light by M. Montigny, in recent examination of poplars bordering part of a road in Belgium between Rochefort and Dinant. The part in question is some 4,600 meters in length, and runs westward; it is level for some distance, then rises gradually to a height of 61 meters, through a wood, traverses a wooded plateau 200 meters in extent, then descends, still through wood, to a plain. A telegraph wire runs near the row of Virginia poplars on the north side, and it appears that, out of nearly 500 poplars forming this row, 81, or a sixth, have been struck by lightning. Hardly any have been struck in the other row. The trunks have been mostly struck on their south side and nearly opposite the wire. Comparing different portions of the road, it is found that in the horizontal part none of the (129) trees show injury from lightning, or at most only one (a doubtful case), but as the road rises through the wood the cases quickly multiply, and on the wooded plateau as many as 9 out of 14 trees, or 64 per cent, have been struck. On the slopes the proportion is 25 per cent.

M. Montigny distinguishes three kinds of injuries: (1) the bark torn and detached on a limited part of the trunk; (2) a furrow, straight or (rarely) spiral, made on the tree, from near the wire, down to the ground; and (3) a peculiar oval wound, with longer axis vertical, and lips colored light brown. Now, the furrows, which are probably due to the most violent discharges, are relatively most frequent on the plateau and on the western slope, which the storms usually reach first. M. Montigny is of opinion that the lightning, while provoked by the wire, does not strike this first, then the tree, but strikes the tree directly. His conception of the process is to the following effect: Suppose a thunder cloud charged with positive electricity. A long telegraph wire under it, though insulated, may acquire as great negative tension in the nearest part as if in direct communication with the ground, and the tension is greater the nearer to the cloud. While the inductive influence affects the wire most, near objects, such as trees, share in the influence according to their conducting power. The lightning, attracted in the direction of the wire, yet does not strike this, the insulating cups presenting an obstacle to its prompt and rapid escape. It finds a better conductor to earth in a neighboring poplar, wet with rain. From the facts indicated it results, that of two similar houses, one built on a plain, the other in a wood, and having a telegraph wire fixed to them, the latter is the more liable to injury by lightning, and the danger is greater if the wood inclosing the house be upon an eminence.

Positive Pictures on Gelatino-Chloride.

Two methods of preparing the chloride emulsion are considered—the first method (without ammonia) yielding pictures which may be bright brown or reddish toned, according to the developer selected; while the same emulsion, if digested for twenty-four hours, can be made to yield pictures having a fine violet-black tone.

The non-ammoniacal emulsion is prepared much after the manner generally adopted for the production of a gelatino-bromide emulsion, the soluble chloride being contained in a warm gelatinous solution, to which the silver nitrate is gradually added, while the mixture is kept in continual agitation. Twenty-five parts of gelatine are dissolved in 200 parts of distilled water, together with 7 parts of sodium chloride, and 6·40 parts of ammonium chloride, it being convenient to allow the gelatine to swell for half an hour before applying heat. The gelatine being dissolved, and the solution at 50° C. (122° F.), a silver nitrate solution containing 15 parts of the salt in 200 parts of water is gradually added with agitation; and it should be noted that it is advisable to warm the silver solution to the same temperature as the gelatinous liquid.

The chloride is deposited, under these circumstances, in a very fine state of division, and the mixture is at once poured out to set, a beaker or drinking glass serving very well as a mould, and external cooling may be resorted to when it is desirable to work expeditiously. The gelatinized emulsion may now be cut into strips by means of a horn spatula or a strip of glass; but if a more perfect state of division is desired, it may be forced, nutmeg grating fashion, through a piece of wire netting. In either case the material is tied up in a piece of muslin, and is suspended in a vessel containing a considerable quantity of water, this being changed five or six times, unless a stream can be kept flowing through the vessel. The washing may occupy a period of six to twenty-four hours, according to the state of division to which the emulsion is reduced, the temperature, the frequency with which the water is changed, and other circumstances. This operation being satisfactorily finished, the emulsion is well drained, and is next melted at a temperature of about 50° C. (= 122° F.)

As regards the filtration of the emulsion, fine linen, purified cotton wool, or a special paper which is sold for the purpose at the German photographic stock houses, may be used. The emulsion is now quite ready for use in coating either ordinary glass, opal glass, or paper; but if it is considered desirable to preserve the emulsion in the jelly form any great length of time, it is advisable to add 0·2 part of thymol or phenol to each 100 parts of emulsion, the preservative agent being previously dissolved in 5 to 10 parts of alcohol.

For the dark room, used for the preparation of the chloride emulsion, it is sufficient to provide the ordinary yellow or orange illumination required in working the wet collodion process.—*Photographic News.*

Influence of the Weight of the Air on the Flow of Springs.

In the geological section of the British Association, Mr. Baldwin Latham, M. Inst. C.E., read an interesting paper on the influence of barometric pressure on the discharge of water from springs. He stated that it was alleged by some of the long established millers on the chalk streams that they were able to foretell the appearance of rainfall from a sensible increase in the volume of water flowing down the stream before the period of rainfall. He had therefore undertaken a series of observations to investigate the phenomena, and he found, in setting up gauges on the Bourne flow in the Caterham Valley, near Croydon, in the spring of the present year, and selecting periods when there was no rain to vitiate the results, that whenever there was a rapid fall in the barometer there was a corresponding increase in the volume of water flowing, and with a rise of the barometer there was a diminution in the flow. The fluctuation in the flow of the Croydon Bourne due to barometric pressure had at one period exceeded half a million gallons per day.

The gaugings of deep wells also confirmed those observations; for where there was a large amount of water held by capillarity in the strata above the water line, at that period of the year when the wells became sensitive and the flow from the strata was sluggish, a fall in the barometer coincided with a rise in the water line, and under conditions of high barometric pressure the water line was lowered. Percolating gauges also gave similar evidence, for, after percolation had ceased and the filter was apparently dry, a rapid fall of the barometer occurring, a small quantity of water passed from the percolating gauges. The conclusion he arrived at was that the atmospheric pressure exercises a marked influence upon the escape of water from springs. The increase in the flow of the water was attributed to the expansion and escape of the gases held by the water under low barometric pressure, which caused the water to escape more freely, while with high barometric pressure there was a condensation of the gases, which led to a retardation in the flow.

MISCELLANEOUS INVENTIONS.

Mr. Bat Smith, of Spanish Camp, Texas, has patented an improved composition for preserving wood, consisting of eight parts of coal tar, one part of crude carbolic acid, and three-fourths part of crude pyroligneous acid, mixed and heated, but not permitted to boil. The wood to be treated is placed in a vessel filled with the compound, where it remains until saturated.

Mr. Frank B. Miller, of Enon, Clark County, O., has patented a novel design for a sleigh. A life-size, graceful deer is represented on each side of the sleigh, complete in every respect, from the hoofs to the horns. It is made of of one and one-half inch material, and is beautifully rounded and carved on the outer surface, the legs first being tapered to size of runner. The runners are single bent and are fastened together in front (in addition to a light rod) by two darts or arrows, neatly trimmed with gold and silver paint. The dash, back, and seat are so adjusted as not to mar the general features of the design.

Mr. Edward E. Bishop, of Littleton, N. H., has patented an improved incubator which is simple, economical, and efficient.

An improved chimney-flue brush has been patented by Mr. David C. Greenway, of Abingdon, Va. The object of this invention is the production of a brush by which chimney and other flues may be conveniently and thoroughly swept, and one which is adapted to flues of different sizes.

An improved cultivator has been patented by Mr. Moses S. E. Pittman, of Harlem, Mo. The object of this invention is to facilitate the cultivation of plants and the adjustment of the cultivators to the distance apart of the rows of plants.

Mr. William S. Plummer, of San José, Cal., has patented an apparatus for pressing potatoes and other vegetables, and at the same time laying the pressed material upon trays in a convenient form for drying.

Messrs. John Greek and Francis M. Sellman, of Evansville, Ind., have patented an improved expanding rock drill for cutting a recess or cavity at the bottom of a drilled hole in a rock, or a coal or other mine, for the purpose of receiving the charge of powder or other explosive substance used in blasting. The invention consists in a novel combination with a drill rod or holder, of a pair of bits or drills, and the combination therewith of a cone of peculiar construction for expanding the bits or drills.

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.

TO THE CONSTANT CURRENT CURE COMPANY,
307 Main St., Buffalo, N. Y.

SIRS: Your Constant Current Electric Generator, which I have used for several weeks, has entirely cured me of rheumatism, and has proved extremely beneficial in other ways. With it I have counteracted the debilitating effects of overwork and warm weather, and have been invigorated and imbued with fresh vitality. Three of my friends, to whom I loaned my generator, have each ordered one from you. W. R. WARREN,
45, 47, and 49 William St., N. Y.

For Sale.—A complete set of Patterns, Flasks, and Core Arbors, for making Cast Iron Flanged Pipe, Elbows, Tees, and Greenhouse Fittings. Will be sold low to clean out a branch of a business. Address B, Box 2253, New York.

For Sale.—9 in. x 9 in. Propeller Engine and Boiler, Shaft, Wheel, Pipes, etc. W. J. Sanderson, Syracuse, N. Y.

Cheap Engines, Boilers, Pipe, etc., for sale. See adv. of Logan Machine Works on page 268 this issue.

A pair of 15 x 24 Engines, good as new, for sale cheap, as they must be removed. J. C. Todd, 10 Barclay St., N. Y.

Pays well on small investment.—Stereopticons, Magic Lanterns, and Views illustrating every subject for public exhibitions. Lanterns for colleges, Sunday schools, and home amusement. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., N. Y.

Superintendent wanted.—A man competent to superintend a works employing about 300 hands in building machinery and tools, and in manufacturing goods for a regular trade. None but a first-class man in all respects need apply. Address B, Box 2333, New York.

Constant Current Electric Generator. Price, $3. Constant Current Cure Company, 307 Main St., Buffalo, N. Y. Send for circular. See advertisement, p. 253.

Clark & Heald Machine Co. See adv., p. 206.

Ajax Metals for Locomotive Boxes, Journal Bearings, etc. Sold in ingots or castings. See adv., p. 236.

New Comb'd Milling and Gear Cutting Machines, large range. C. A. Condé & Co., Makers, Philadelphia, Pa.

A valuable article on the Treatment of Acute Rheumatism, by Alfred Still, M.D., will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 299. Anything from the pen of this eminent and experienced physician is interesting and instructive.

New Method of Graining, etc. J. J. Callow, Cleveland, O.

Foot Lathes, Fret Saws, &c. 90 pp. E. Brown, Lowell, Mass.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Alden Crushers. Westinghouse Mach. Co., Pittsb'g, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Cope & Maxwell M'f'g Co.'s Pump adv., page 254.

Punching Presses & Shears for Metal-workers, Power Drill Presses, $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N. Y.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. 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.

Wood Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro. 234 Broadway, New York.

Malleable and Gray-Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 19 Cortlandt St., N. Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

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

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 206.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad., p. 221.

Safety Boilers. See Harrison Boiler Works adv., p. 222.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 221.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 238.

The Sweetland Chuck. See illus. adv., p. 238.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Skinner's Chuck. Universal, and Eccentric. See p. 236.

For Machinists' Tools, see Whitcomb's adv., p. 238.

The American Electric Co. and Proprietors and Manufacturers of the Thomson Houston System of Electric Lighting of the Arc Style. New Britain, Conn.

See Bentel, Margedant & Co.'s adv., page 254

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

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

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Telegraph, Telephone, Elec. Light Supplies. See p. 253.

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

Gear Wheels for Models (list free); Experimental Work, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Gould & Eberhardt's Machinists' Tools. See adv., p. 222.

The Medart Pat. Wrought Rim Pulley. See adv., p. 253.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 254.

Centrifugal Pumps, 100 to 35,000 gals. per min. See p. 253.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 254.

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

Lathes, Planers, Drills, with modern improvements. The Pratt & Whitney Co., Hartford, Conn.

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.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for 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.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

Common Sense Dry Kiln. Adapted to drying all of material where kiln, etc., drying houses are used. See p. 254.

4 to 40 H. P. Steam Engines. See adv. p. 254.

The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Av., Phil. Pa.

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) G. E. M. asks: Can you give me a recipe for making black ink that will flow freely, be durable, and brilliant jet black at time of writing? There are plenty of inks that turn black. I want an ink that writes black and stays black. A. Try the following: add to a pint good iron gall ink from ten to fifteen drops of nitric acid, and heat over the water bath until reduced about one-fifth in volume, then add six drachms of pyrogallic acid and half an ounce of neutralized indigo-sulphate (paste). See other receipts for black inks in SUPPLEMENT, No. 157.

(2) A. W. asks: What are the expansive properties of air compared with steam? Suppose a vessel filled with air, say at 30 lb. pressure, we reduce the space occupied by the air to one-half, would the pressure be just doubled, or what would the pressure then be per square inch? A. Air follows the same law as steam. Reducing the volume one-half doubles the pressure within a small fraction, if the temperature remains unchanged. 2. How are air guns made? A. You will find a description of air guns in "Appletons' Dictionary of Machines, etc.," also in "Appletons' Dictionary of Applied Mechanics."

(3) O. R. M. asks: What kind of paper is used in making paper canoes, and how is it cemented together? A. Sheets of stout manila passed through a hot bath of aqueous solution of zinc chloride (at 75° B.), pressed strongly together and then soaked in dilute aqueous soda solution containing a small amount of glycerin, cohere to form a strong, stiff, waterproof board admirably adapted to the construction of small boats. Single sheets of paper passed quickly through the zinc chloride bath, pressed and washed and dried, are waterproof, and may be otherwise joined to form waterproof boards by any suitable cement.

(4) J. M. B. asks: How can I make indelible ink of good quality for marking on linen? A. (1) Add caustic alkali to a saturated aqueous solution of cuprous chloride until no further precipitate forms; allow the precipitate to settle, draw off the supernatant liquid with a siphon, and dissolve the hydrated copper oxide in the smallest possible quantity of ammonia. It may be mixed with about six per cent of gum dextrine for use. Before washing pass a hot iron over the writing. (2) Asphaltum, 1 part; oil of turpentine, 4 parts; dissolve and temper with printer's ink. Best used with a stamp. See other recipes on this page.

(5) G. A. H. inquires how to make a durable whitewash for outbuildings. A. Slake half a bushel good lime in boiling water in a covered vessel, and strain it through a fine sieve; add a peck of salt dissolved in a small quantity of hot water, three pounds of rice boiled with water to a thin paste, one pound of Spanish whiting, one pound of glue softened by soaking in water and then dissolved over a water bath, and five gallons of hot water. Agitate, cover from dust, and allow to stand several days. Apply hot. Slaked lime or hydraulic cement mixed with skimmed milk makes a cheap and durable paint for outdoor work.

[OFFICIAL.]

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FOR WHICH

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September 20, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Cheap Engines, Boilers, Pipe, For Sale at a Bargain, to close out estate before 1st January.

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10,000 ft. ¾	inch pipe, steam pipe,	0 08½
10,000 ft. 3½	inch pipe, lap weld, 500 lb. pressure	0 39
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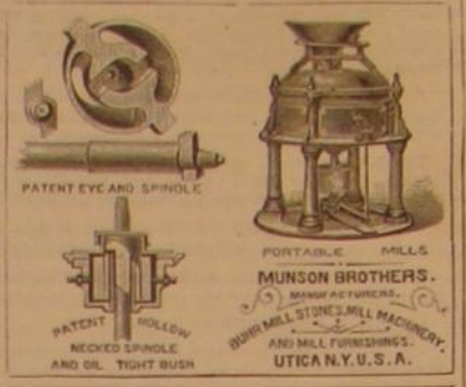

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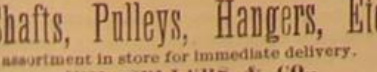

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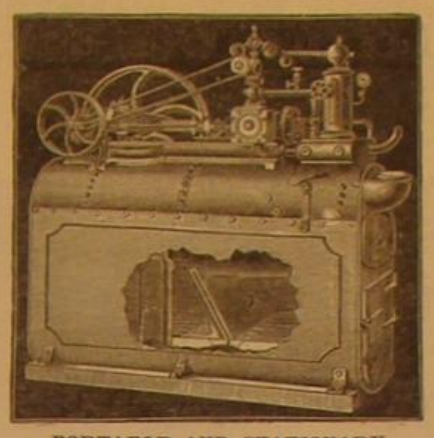

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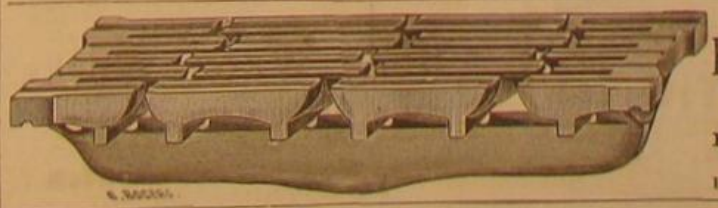

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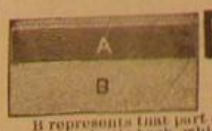

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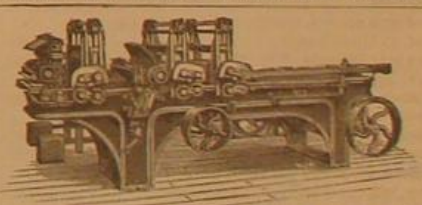

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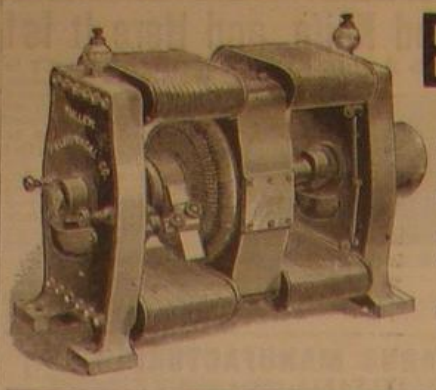
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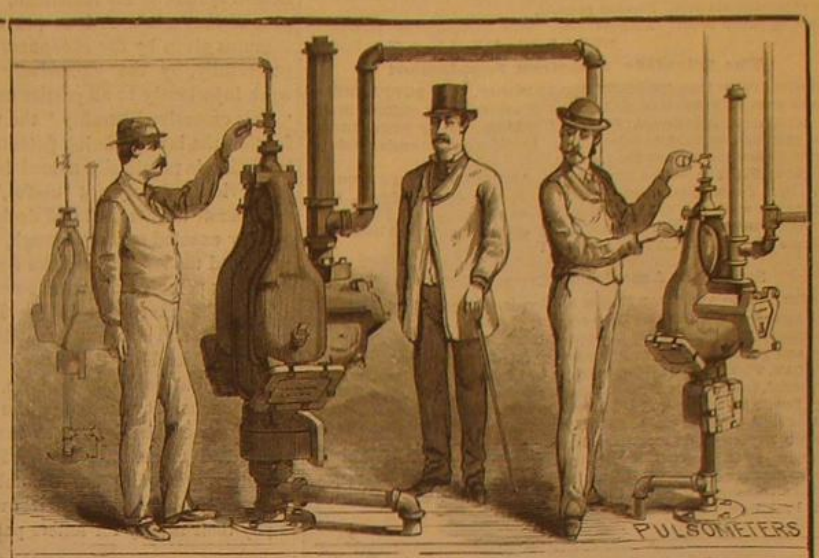

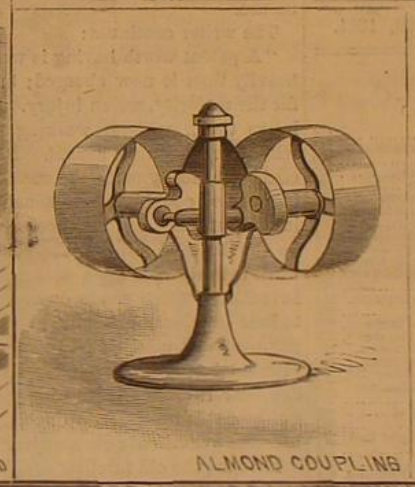

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PATENT REFORM.

About this time every year, particularly if there is no topic of general interest before the country, there appears in one or the other of our morning papers an article on patent reform, thrown out, apparently, as a "feeler." The tone and sentiment of these articles are always the same. The line of argument is substantially identical in all, and the internal evidences of style and motive strongly encourage the hypothesis that they have a common source which is not altogether unknown to American inventors and patentees. This year the *Times* gets it.

Taking for his text the late action of the *English* National Chamber of Trade favoring the proposed reform of the British patent law in the direction of lessened fees and extended terms of patent right, thus approximating the British system to the American, the writer objects, on the ground that it is a serious practical question whether the stimulus given by the cheapness of patents, and, still more powerfully, by the excessively easy granting, does not work injuriously to all parties except brokers and lawyers. "This excessive liberality," the writer says, "is extended so far that the law confining patents to 'any new and useful' invention is practically a dead letter. Patents are granted for devices not only not 'useful,' but for those which will not operate as intended and declared to do. . . . Nor is novelty exacted strictly enough, for every person who has examined the subject can cite devices which have been substantially patented over and over."

That the examiners in the Patent Office *do not* know everything and are not incapable of making mistakes the warmest friend of the patent system would not hesitate to admit; but he would hesitate, we think, to accept that as an excuse for lessening the encouragement which the patent system holds out to inventors. It is presuming a great deal to assume, as the *Times* writer does, that our inventors generally are mentally incompetent and need to be protected against their own unreasonable eagerness to pay their money for letters patent on things that are of no use.

The writer continues:

"A patent worth having is worth paying for much more heavily than is now charged; but the worthless ones, now far the majority, are an injury. Any change which tends to lessen these, without working too much offsetting harm, will prove a public benefit. It is plain that if government could practically make the successful invention pay accordingly there could be no reasonable objection; the difficulty in this is to pick out the successful ones at first, or to follow up the list and sift out the good ones afterward, but this work is fairly well done automatically by natural selection. Inventions which prove commercially valuable can afford to bear supplementary taxes, and those which are not worth payment will escape it. Hence the English system of supplemental fees is thoroughly sound, taxing patents which can bear it and extinguishing the useless ones. This extinguishment is itself very valuable, for a useless patent often becomes vexatiously obstructive."

Here are the old familiar sophistries. The underlying assumptions are all opposed to the spirit and policy of the system which has so bountifully demonstrated its practical wisdom that even conservative England is beginning to appreciate it.

The idea that an inventor, who has brought forth, painfully or otherwise, something of value to the rest of the community, should be compelled to pay for the privilege, heavily or lightly, is simply absurd. That the penalty imposed should increase with the amount of the benefaction is still more absurd. Indirectly the successful invention does contribute to government support in taxes in proportion to the rate at which it increases individual and public wealth; but that is for service by the government other than and independent of the issuance of an official certification of the invention in the form of letters patent. The assertion that the majority of patents are worthless is so contrary to the evidence of fact that it cannot be set down to ignorance. The point of the whole paragraph lies in the advocacy of the policy of extinguishing "useless patents;" and its mischievousness turns on the assumption that all patents which are not speedily developed and made commercially productive are useless. This position too is flatly contrary to the evidence of fact, as shown in history and illustrated in the testimony taken in official investigations in this country and in Europe.

It is the position taken by those, and those only, who are pecuniarily interested—as principals or attorneys—in so modifying the operation of the patent law as to facilitate the seizure and enjoyment of patented inventions without the preliminary formality of consulting the inventor or incurring any subsequent risks of damages for infringement. With a large number of classes of inventions it rests with a few wealthy organizations to decide absolutely whether a new invention within the class, however meritorious it may be, shall or shall not be speedily developed and made remunerative to the patentee. Such organizations, or many of them, would no doubt assent heartily to the *Times* writer's position that "the extinguishment of all [patents] which do not develop value within a term of years would be beneficial;" but the public who do not wish to wait for improvements until the patents on them have been officially killed, and the inventors who invent primarily for their own betterment and not to swell the income of railway companies and the like, are inclined to take another and more equitable view of the rights of the patentee, and at the same time prefer that the benefits to be derived from inventions shall be more equitably distributed.

HAMILTON E. TOWLE.

The recent death abroad of Hamilton E. Towle, inventor, mechanical engineer, and manufacturer, of this city, recalls the remarkable achievement which first brought his name prominently before the public. In September, 1861, Mr. Towle, then a young graduate of the Lawrence (Mass.) Scientific School, was a passenger on the Great Eastern, from Liverpool to New York, when her rudder post was broken in a storm. Seeing that the efforts of the ship's officers to retrieve the disaster were useless or worse, young Towle drew up plans for a temporary steering apparatus, and, backed by some prominent American passengers, was granted a hearing and grudgingly allowed to carry his plan into effect, thereby saving the ship, which had been rolling helplessly in the trough of the sea for many critical hours. This historical feat of engineering, requiring infinite pluck and skillful labor as well as rare genius, was described at length and illustrated by engravings in the SCIENTIFIC AMERICAN of October 26, 1861.

Mr. Towle was a mechanical experimenter and inventor from boyhood, and his active and ingenious mind bore good fruit for many years. Previous to his last illness Mr. Towle was at the head of the Towle Manufacturing Company, of this city.

The Microphone in Observatories.

Mr. Van Rysselberghe's idea of using the microphone in observatories has been adopted in the observatory at Geneva, and by the aid of the instrument, in combination with the telephone, the sound beats of the normal pendulum can be heard in every part of the building. The observatory is also connected with the Hôtel Municipal, so that the beats of the electric clock regulator in that building can be heard and compared with the pendulum beats.

A Large Refrigerating Machine.

The Boyle Ice Machine Company, of Chicago, have undertaken to cool artificially the beer storage and fermenting rooms of the Philip Best Brewing Company, of Milwaukee. The capacity of the rooms to be cooled exceeds 1,600,000 cubic feet. The contract price of the refrigerating machinery is $80,000. It is estimated that at least twenty freight cars will be required to transport the machinery and connections, exclusive of the steam boilers. The Boyle Company employ the ammonia process.

The Lighthouse Service.

There are now under the control of the Lighthouse Board about seven hundred lighthouses, besides something like eight hundred lights, on interior rivers. In their annual report the Board ask for $50,000 to introduce electric lights in several of the more prominent lighthouses. The lamps proposed for this purpose have been thoroughly tested, and are said to be in every way satisfactory and much more effective than the lights now in use. The estimates for new work and for the maintenance of the service amount to about $3,000,000.

A Railway Injured by an Earthquake.

A severe earthquake was lately felt in the southern part of the North Island, New Zealand. No lives were lost, but in some of the townships in the Manawater district scarcely a chimney was left standing. In Foxton, for instance, no less than 250 were thrown down. Fissures extending for many miles are reported to have been made, and the railway line was rendered unsafe in that neighborhood, owing to the undulations of the earth alternately raising and depressing the rails. Since the large shock a good many of a slight nature have occurred.

Constant Sources of Electricity.

A section suitably cut in a hemihedral crystal with inclined surfaces and placed between two leaves of tin, constitutes a condenser which is capable of charging itself when compressed. With this system we may realize a new instrument, a condenser source, which possesses special properties. It may serve as a standard of static electricity for measuring charges and capacities. The authors give in this memoir an absolute measurement of the quantities of electricity liberated by tourmaline and quartz under a given pressure.—*MM. Jacques and Pierre Curie.*

Angular Distance of Colors.

The projection of a table of colors upon the sides of an equilateral triangle renders it possible to determine the exact angular distance of the colors, a result which has not yet been obtained, and which suffices to connect together the facts at present known. The author gives a diagram representing the law of the mixture of colors, and which will be advantageously substituted for Newton's rule.—*A. Rosenstiehl.*

Underground Telegraph in Philadelphia.

The work of laying the conduit for the underground telegraph system on Market street has now proceeded as far as Eleventh east from the public buildings, and work is progressing at the rate of half a square a night. The conduits have twenty separate chambers. Each chamber has a capacity for fifty wires, and connection is made by means of manholes, which are located at each square.—*Philadelphia Record.*

THE COTTON PLANT AND ITS FIBER.

Linnæus recognized five primary species of the cotton plant. Other botanists have made the number seven, eight,

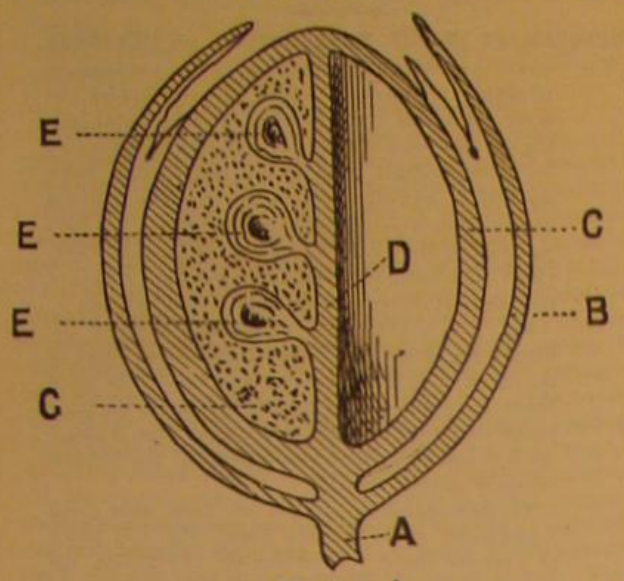


FIG. 1.

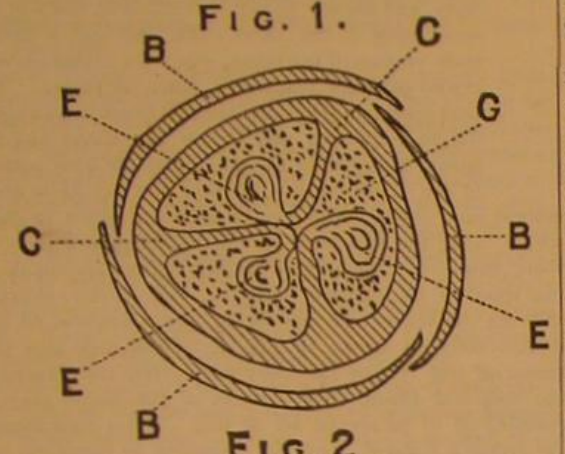


FIG. 2.

A. Stem.—B. Section of calyx.—C. Section of carpel.—D. Midweb with seeds attached.—E. Section of seeds.—G. Plexus of young cotton fibers.

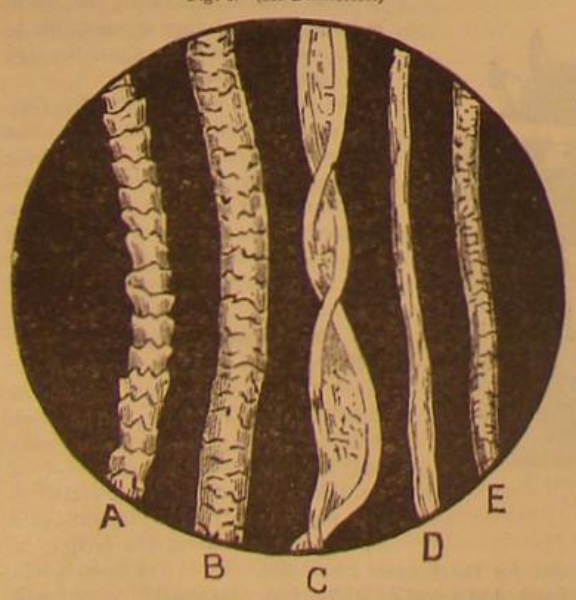
LONGITUDINAL AND TRANSVERSE SECTIONS OF EGYPTIAN COTTON POD.

and even ten. One of the later authorities, Professor Parlatore, finds seven species:

1. *Gossypium arboreum*, which occurs in Ceylon, the Moluccas, Arabia, Senegal, etc.
2. *G. herbaceum*, growing in Siam, China, India, Italy, etc.
3. *G. sandwichense*, from the Sandwich and other Pacific islands.
4. *G. hirsutum*, which furnishes our American upland cottons.
5. *G. barbadense*, including the Sea Island and Barbadoes cottons.
6. *G. tahitense*, from Tahiti, the Society Islands, etc.
7. *G. religiosum* or *peruvianum*, which comprises Peruvian and other cottons with seeds in adherent files.

In his new and valuable work on the "Structure of the Cotton Fiber in its Relations to Technical Applications," Mr. F. H. Bowman holds that the best practical division is that of herbaceous, shrub, and tree cotton. The herbaceous cotton is the most valuable, and is that from which the large American crop is obtained.

Fig. 3.—(325 Diameters.)



A. Fiber of Chinese wool.—B. Fiber of Leicestershire wool.—C. Fiber of cotton.—D. Fiber of silk.—E. Fiber of mohair.

The cottons grown in different parts of the world differ in the length and fineness of the staple, the range being between the short native cotton of India, with a fiber scarcely exceeding three-fourths of an inch, and the long stapled Sea Island cotton grown on the shores of Georgia and Florida, with a fiber over two inches long.

Mr. Bowman gives (pp. 99, 100) a table of the various classes of cottons quoted in the Liverpool market, giving the name, place of growth, species, average length of staple, and the spinning "counts" for which each is generally used.

The "Sea Islands" cottons (*G. barbadense*) are used for all the finest counts, which are spun up to 2,000s. The cotton from the coast of Georgia and Florida stands at the head, with an average length of staple of 2·20 inches.

Next comes the cotton of the same species, grown on Florida uplands, with a staple 1·95 inches long. The same grown in Australia and the Pacific islands measures from 1·65 to 1·88 inches. The so-called Sea Islands cotton from Venezuela (La Guayran, *G. hirsutum*) measures 1·75 inches; while that from the coast of Peru (*G. peruvianum*) measures 1·50.

Next in length of staple comes "Egyptian cotton," the best of which (from *G. barbadense*), with a staple of 1·50 inches, is spun up to 200s. The brown Egyptian (from *G. herbaceum*) has a staple of 1·40 inches, and is spun up to 140s. The white Egyptian (from *G. hirsutum* and *G. peruvianum*) has a staple of 1·25 inches, and is spun up to 80s. The Smyrna cotton, from the Levant and Greek islands, is classed with, and is almost equal in quality to, the last named.

Next in order come the "Brazilian" cottons, which include all the South American and West Indian products, except the long-staple cottons already named. The staple ranges between 1·15 inches and 1·35 inches. Alone and mixed with American and Egyptian cottons the Brazilian cottons are spun up to 60s.

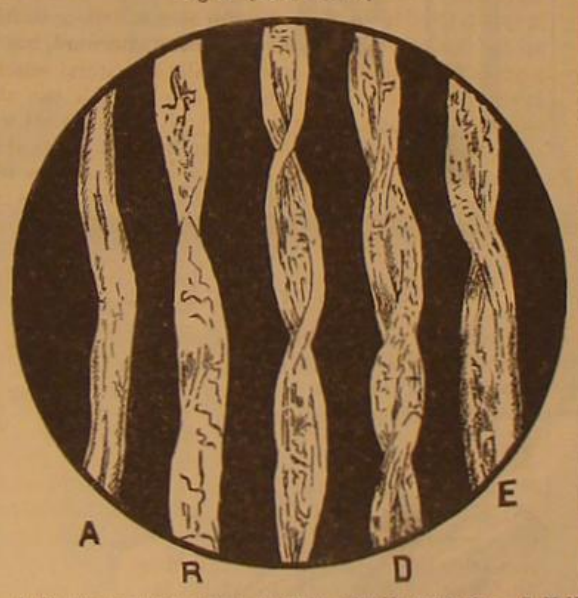
"American" cottons comprise those known as *Upland*, from Georgia and South Carolina; *Mobile*, from Alabama and adjacent States; *Orleans*, from Mississippi, Arkansas, and Louisiana; and *Texas*, from that State. The species is *G. hirsutum*, and the average lengths of staple are, in the order named: 1 inch, 1·05 inches, 1·10 inches, and 0·95 inch. Alone these cottons are spun up to 50s; mixed with Egyptian and Brazilian, up to 60s.

The "Indian" or Surat cottons, and the "Madras" cottons, under eight or ten special names, include the products of the several divisions of Hindostan and British Burmah. The staple varies between 0·90 inch and 1·20 inches, the shortest being "Rangoon," from Burmah, the longest, "Hingunghat," from the Central Provinces. Alone these cottons are spun up to 32s; mixed with American, up to 40s.

The "African" cottons are of like grade with the Indian. These, of course, do not include the Egyptian.

By "counts" in the foregoing descriptions is meant the number of hanks of 840 yards spun from one pound of cot-

Fig. 4.—(325 Diameters.)



A. Glassy, structureless fiber.—B. Thin, pellucid, unripe fiber.—C. Half ripe fiber, with thin cell wall.—D and E. Fully mature and ripe fiber, with full twist and thick, well-defined cell wall.

ton; a count of 200 means 200 × 840 yards, or 168,000 yards to the pound. American Sea Island cotton has been spun into counts as high as 2,150 hanks to the pound, so that one pound of this yarn would have a length exceeding 1,000 miles. The short American staple will average about 30 miles of yarn to the pound, as it is ordinarily spun.

A ready conception of the relative proportions of the cotton fiber may be obtained by supposing the fiber magnified until it should be one inch in diameter. In this case the ordinary American cotton fiber would measure 100 feet in length, while an average fiber of Sea Island cotton would reach over 130 feet.

The fineness of the fiber may be judged from the fact that it takes from 14,000 to 20,000 filaments to weigh a grain. If the separate fibers of a pound of ordinary cotton could be placed end to end in a straight line they would reach about 2,200 miles. The fibers are far from uniform in length, the longest, as a rule, being those which grow on the crown of the seed; the shortest grow at the base of the seed. The manner in which the fiber is distributed about the seeds in the boll is shown in Figs. 1 and 2.

The relative strengths of the different sorts of cotton fibers have been partially investigated by Mr. C. O'Neill. The results as quoted by Mr. Bowman are arranged as follows, the weights indicating the mean breaking strain: Sea Island (Edisto), 83·9 grains; Queensland, 147·6 grains; Egyptian, 127·2 grains; Maranham, 107·1 grains; Benguela, 100·6 grains; Pernambuco, 140·2 grains; New Orleans, 147·7 grains; Upland, 104·5 grains; Surat (Dhollerah), 141·9 grains; Surat (Comptah), 163·7 grains. In proportion to the sectional area of the fiber the Egyptian cotton appears to be relatively strongest. In the other cases the breaking strains are roughly proportional to the coarseness of the fiber. These measurements are set down as approximate only.

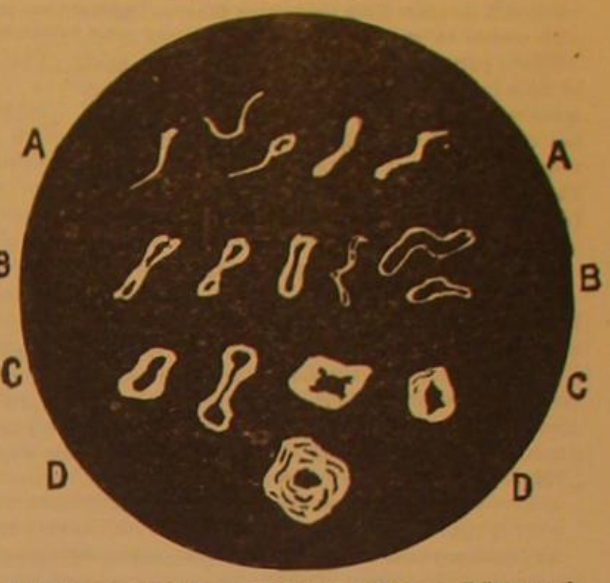
When examined under the microscope the cotton fiber is usually seen to be an irregular, flattened, somewhat twisted tube; frequently the tubular form is lost by collapse, the fiber appearing ribbon-like, with the edges thickened.

In Fig. 3, copied from the work of Mr. Bowman, the appearance of the fiber is contrasted with that of fibers of wool, silk, etc.

Mr. Bowman finds that, speaking generally, cotton fibers may be divided into three classes:

1. Those in which no internal structure is apparent.
2. Those in which the structure seems to be simply tubular, with a well-defined transparent cell-wall.
3. Those in which the structure is tubular and the interior of the cell is filled with secondary deposits, almost entirely

Fig. 5.—(450 Diameters.)



A. Unripe unmatured fibers.—B. Half ripe fibers.—C. Fully matured and ripe cotton.—D. Section of fiber showing laminated cell walls.

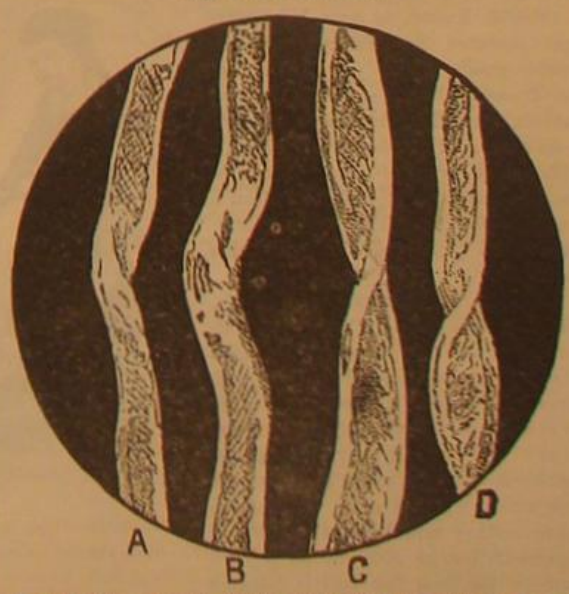
SECTIONS OF COTTON FIBER.

filling up the cavity and giving the fiber a dense, almost opaque appearance.

The first of these classes occurs most frequently in early and unripe cotton, and apparently also in cotton which is overripe from having been *left too long* ungathered. In both cases the outer sheath of the fiber seems to be of extreme thinness.

The structureless appearance of unripe cotton is attributed to the fact that the fiber has been detached from the seed before the period when the filling up of the interior of the elongated cellular sac which forms the fiber has commenced; in the overripe cotton the thickness of the outer wall seems to have been reduced by the process of absorption which sets in when an organic structure has reached maturity. In certain other fibers the lack of internal structure is partial, portions of their length appearing solid and incapable of absorbing dyes, a condition analogous to "kemps" in wool. This kempy structure seems to be more frequent in short than in long fibers, and probably varies with the climatic and other conditions of the growth of the plant.

Fig. 6.—(300 Diameters.)



A and B. Fibers of wild African cotton.—C and D. Fibers of coarse Peruvian cotton.

COTTON FIBERS SHOWING SPIRAL STRUCTURE.

The third class of fibers are the most valuable, since they absorb dyeing materials best, and in some cases retain the dye in the inner tube in crystalline masses. When acted upon by many chemical reagents the rigidity and solidity of the tube walls of these fibers appear to be increased, and in some cases the thickness of the wall also. Mr. Bowman says of these: "It seems as if in this fully matured fiber the central cells, up which the sap passed during the period

of growth, had been fully absorbed into the tube wall when the full length of the hair was reached and the vital action which kept the cell contents in activity [was] arrested; and while the interior cells are fully matured they are shrunk in toward the denser walls which form the outer sheath, but without losing their structure, so that they are ready to be expanded again when their interior is filled with fluid or solid contents, as the case may be. In this class of fibers the central tube is always well defined. Of course, as in the case of the second class, the irregularities and twists in the fibers are quite visible, and they shade into the first and second varieties; but they form by far the largest portion of every cotton sample, and hence may be taken as the typical fiber.

In Fig. 4 are represented these three classes of fibers. Fig. 5 exhibits a number of sections of cotton fiber, as found in the different stages of growth. Fig. 6 shows the spiral structure of different cotton fibers.

Unfortunately Mr. Bowman's examinations were made at a distance from the cotton field, so that he was unable to study the mutual relations of the different parts of the fiber and of the different kinds of fiber in the green or growing state. His specimens were all selected after the cotton had been not only dried, but ginned and pressed. A corresponding study of the varying appearance of the fiber in its natural course of development could not fail to be valuable

Technical Teaching in England.

The increasing interest in technical instruction in England is shown by the fact that more than 2,500 students were taught in the classes of the London City and Guilds Institute last session. The third examination of the Institute was held lately at 115 centers. Out of 1,563 candidates 895 passed in one, and 65 in two subjects. The number of papers examined this year by the Institute was 1,776, of which 484 were for outside students.

RECENT INVENTIONS.

An improved coin holder has been patented by Mr. John Chantrell, of Bridgeport, Conn. The object of this invention is to hold rolls of coin in such a manner that the coins can be readily seen and counted and conveniently handled.

Mr. Jacob G. Titus, of Silver Cliff, Col., has patented an improvement in that class of journal bearings in which friction is relieved by use of balls or rollers interposed between the journal and its box or casing. The improvement consists in the construction of an axle journal box which adapts it to receive anti-friction balls, and also in the provision of elastic and anti-friction end bearings for receiving the end movement or thrust of the axle journal.

An improved cornstalk shocker and binder has been patented by Mr. John B. Whitbeck, of Coxsackie, N. Y. The invention consists in a roller supported by standards and carrying a transverse bar and a cord for drawing the stalks together to be bound. After binding the shock the roller and transverse bar may be removed.

Mr. Adrian C. Selby, of Covington, Ky., has patented an improved soap composed of tallow, olive oil, sal-soda, unslaked lime, rosin, borax, alum, white wax, spermaceti, and benzine.

An improved game has been patented by Mr. Stephen W. Roe, of Albany, N. Y. The object of this invention is to provide a new and simple game which is played in the same manner as billiards.

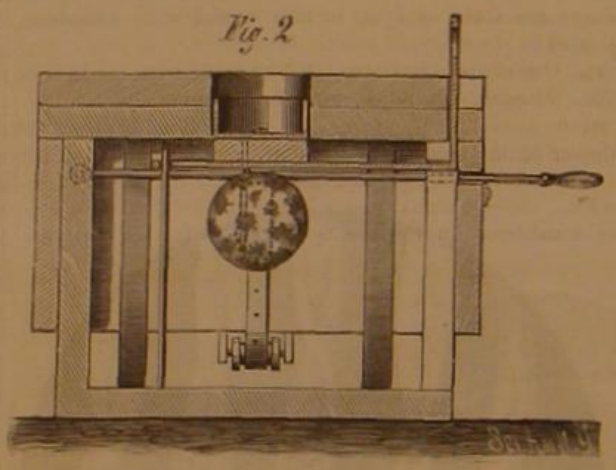
Anna M. Knoop, of New York city, has patented an improvement in crochet goods, which can be used as hat frames, book satchels, sewing baskets, etc. The invention consists in an article of crochet work which is stiffened by means of glue, gelatine, or similar substance, is then dried on a mould, which gives it the desired form, and is then protected with a suitable varnish.

Mr. John L. Symonds, of Detroit, Mich., has patented an improved trap formed of two trough or tray shaped wire netting sections hinged to each other and pressed toward each other by spiral springs on one of the sections. The trap is provided with a bait hook having a catch at the upper end, which catches on a ball of the other section and holds the sections separated; but as soon as an animal bites on the bait the ball is released and the springs force the two wire netting sections together, thus entrapping the animal.

IMPROVED INVALID BED.

The engraving shows an improved invalid bed recently patented by Mr. George B. Davis, of Richmond, Va. It is constructed so that the head, back, and legs of the patient can be raised or lowered with very little effort on the part of the attendant, and without any exertion whatever on the part of the patient.

The bed is provided with a pivoted leg and foot support, which may be raised or lowered at pleasure, by means of a rope or strap attached to the support and extending upward over the foot of the bed frame. The head support is hinged, and its free end is sustained by a powerful curved spring having sufficient strength to support the headpiece and the portion of the patient's body reclining thereon. A strap attached to the free end of the headpiece extends downward, and passing under a roller is finally drawn through a buckle secured to the head of the bed. The patient's head, shoulders, and the upper portion of the body are drawn down by means of the strap, against the pressure of the spring, and the head support may be fastened at any desired inclination by securing the strap in the buckle.



SECTIONAL VIEW OF INVALID BED.

Both bed frame and mattress are apertured to receive a vessel contained in a movable case attached to a lever arm, by means of which it may be moved up or down or swung around, as circumstances may require.

DAVIS' INVALID BED.

The aperture in the mattress is stopped by a cushion when the vessel is not in use. The cushion is secured to an arm hinged to the under side of the bed frame, so that it is always ready for use.

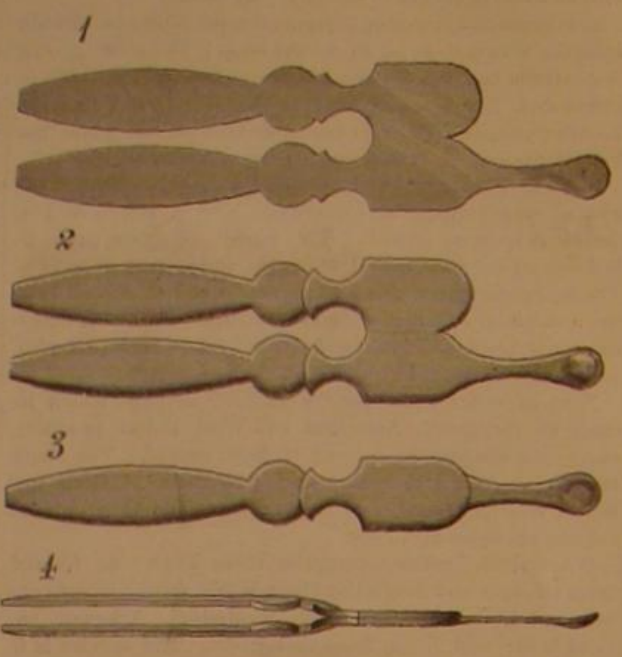
This invention will afford comfort and relief to invalids, and will greatly lessen the labor of nurses and attendants.

Apples for Cows.

Apples, like other succulent food, are good for cows and increase their milk, provided the feeding is begun cautiously in the first place, and gradually and regularly increased. But when cows break into orchards and over gorge themselves, fever and bloating may follow, accompanied with loss or diminution of milk.

IMPROVEMENT IN THE MANUFACTURE OF TWEEZERS.

The engraving shows an improvement in the manufacture of spring tweezers, in which the two blades and body consist of a single piece of sheet metal having the two parts of the body and blades connected by a longitudinal bend in the body. This novel method of making tweezers, or tweezers and ear spoon, from a single piece of sheet metal, has been patented by Messrs. F. L. & J. M. Ellis, of Milldale, Conn. The finished article and the several stages of its manufacture are illustrated in the engravings.



IMPROVED TWEEZERS.

Fig. 1 is a plan view of the first stage of the blank; Fig. 2 is a plan view of the second stage of the blank; Fig. 3 is a transverse section of the third blank, the plane section extending through the body which unites the tweezer blades; and Figs. 4 and 5 are side and edge views respectively of the finished tweezers and ear spoon.

The first operation is to cut out from sheet metal —preferably steel—the twin blank, Fig. 1, it being of a proper shape for forming the two blades, the body, and the ear spoon, all formed in one and the same piece of flat sheet metal, and united at the body portion of the blank, while the blades are otherwise separate from each other, as shown. The next operation is to strike the first blank in a swaging die, to round up and hollow the blades and the spoon, as shown in Fig. 2. Then the body portion of the blank is bent, so that the two parts come toward each other. The blanks are then struck in dies, which bring the two parts of the body together and set them firmly in place, and slightly offsets the shank of the spoon at its junction with the body of the tweezers, to bring it nearer the middle of the thickness of the double body, as shown in Fig. 5. These dies may also round off and remove the sharp edges from the corners of the body and spoon. The corners of the blades may be rounded off in the second set of dies. When thus treated the article is finished, ready for polishing by tumbling and otherwise.

The Vandenbergh "Sea Messenger."

During a recent cruise of the British reserve squadron a trial was made of the new sea messenger invented by Mr. Julius Vandenbergh, of Portsmouth, England. The "messenger" consists of a vessel pointed at each end, three feet six inches in length, made of copper, and lined with cork and composition to resist external pressure. The inner case will carry a weight of sixty pounds, and is designed for the conveyance of letters and other papers from wrecked or disabled vessels. The messenger was thrown over from the Hercules flagship in latitude 56.49 W., longitude 41 E., on the 24th of July. It was picked up on the 18th of August by a fisherman off Hanstholmen, Jutland, and, although it had been twenty-five days in the water, and had traveled about 1,420 miles, it was quite uninjured.

Improvement in Teaching Deaf Mutes.

The Pennsylvania Institution for the Deaf and Dumb has established a school for the tuition of deaf mutes in facial articulation, so as to enable the children, by expression of the face, to understand what is said, and they in turn may, by imitation, pronounce words in answer. This will enable them to communicate with the world at large, although they are not able to hear, and is an advance upon the sign language now in use.

The principal selected is Miss Garrett, an experienced teacher, who has hitherto been engaged in that branch of teaching in New England. This is the first effort of the kind made in Pennsylvania. There are two such schools in Massachusetts and one in New York.—*Philadelphia Bulletin.*

Large Sugar Refinery.

The greatest sugar refinery in the world is now under construction on tidewater, San Francisco. The brick building facing deep water in South San Francisco will be 400 x 150 feet, and thirteen stories high (140 feet). A salt water supply of 3,000 gallons a minute is drawn from the bay, by a tunnel, for the monster condenser. By March next it will be finished at a cost of $1,250,000. Its yearly capacity will be 60,000 tons of refined sugar. Claus Spreckles is the master spirit. It is a result of the reciprocity treaty, by which Sandwich Islands raw sugars are admitted free of duty. He has now thirty vessels employed (all built there) plying between the islands and San Francisco. He has planted sugar cane on a large scale on islands hitherto wild and uncultivated. He has tapped the mountains, and every acre is irrigated. He buys all the native production.

THE NEW SCYLLA AND CHARYBDIS.

BY H. C. HOVEY.

Two pits of extraordinary magnitude have lately been discovered in Mammoth Cave, in such perilous proximity that risk is run of falling into the one while avoiding the other. Hence they have been aptly named "Scylla and Charybdis," in memory of the verse:

"Incidis in Scyllam cupiens vitare Charybdim."

Before giving an account of these particular pits it may be well to explain the formation of such cavities in general. The accompanying diagram (Fig. 1) shows a vertical section of an excavation made by the action of water on limestone—a process requiring an indefinitely long time, and proceeding at a varying rate corresponding to the abundance of the rainfall on the surface. The water, becoming acidulated as it sinks down through the soil, attacks the limestone along its lines of weakness. It thus holds in solution a portion of the rocky strata, in the form of carbonate of lime, and carries it away as it seeks the drainage level, A B. The result at first may be nothing more than an obscure fissure, leading from the sink-holes, S and S', to the outlets, A and E, which, at a later period, become mouths of the completed cavern. As the crevice grows, the chemical action in which it began is aided mechanically by the quantities of sand and gravel swept in through the sinks, and that, being whirled about by the water, operate as a powerful cutting engine. The enlargements thus made are irregular in shape and frequently of great size.

Should the opening through the sink-hole be free from rubbish, the explorer will often find it the orifice of what he appropriately calls a *pit*. Should he gain admittance, however, by the drainage outlet, A, and follow the subterranean channel toward B, he will presently enter the chambers, C and D, and looking aloft to the vaulted roof, he will, with equal fitness, call them *domes*. But let him enter at E, the outlet of a former drainage, and come to a chasm capable perhaps of being bridged (as at F), he will say, as he alternately looks up and down, that a pit is below and a dome above. It may not occur to the explorer till long afterward that the pit, the dome, and the chasm are identical.

To this explanation it should be added, that, if the water has to make its way through a stratum of sandstone before reaching the cavernous limestone, the sink-holes and pits may not coincide; the former simply leading to crevices of no great depth, and the latter being connected with them by winding passages burrowed out between the two formations.

The thickness of what is geologically known as "the Saint Louis limestone," as it exists in Edmondson county, Ky., is between 600 and 700 feet, and it dips to the west at the rate of about ten feet to the mile. The exposed ledges everywhere show the results of erosion by acidulated water, and it is said that nearly every acre has its sink-hole, large or small. According to Prof. Shaler, there are about 500 open caverns in that single county. Many of these are capable of being entered directly from sink-holes; but it is a remarkable fact that, of all the hundreds of these depressions scattered over the area undermined by Mammoth Cave, not one is known to open directly into it! This I attribute to the overlying stratum of Chester sandstone, which resists the action of ordinary acids, although admitting the acidulated water through its seams and crevices, to do its work on the limestone below. In illustration of this, it is regarded as quite certain that the large sink-hole between the entrance to Mammoth Cave and White's Cave is drained through what has long been known as "Little Bat Avenue," in the former. Near the end of this avenue there is a small aperture into which, in 1812, a saltpeter miner dropped his lamp, and in his futile efforts to recover it found that it had gone down into a very deep pit. The incident was noted chiefly because the missing lamp could not be replaced short of Lexington. Messrs. Smith and Buford discovered "Mammoth Dome" in 1843, supposed to be the largest of all known domes. During their explorations they came across, greatly to their surprise, the miner's lamp that had been lost thirty-one years before, and that had been cemented to the floor by stalagmitic drippings!

Among the noted pits and domes in this extensive cavern may be mentioned "Napoleon's Dome," comparatively small, but remarkably symmetrical; "Lucy's Dome," estimated to be 300 feet high, though no means of taking an exact measurement have yet been found; and the "Maelstrom," the pit down whose frightful depths Prentice (son of the poet of that name) descended by a rope held by the guides. The rope was afterward measured and found to be 135 feet long. Most wonderful of all, however, is the cluster of pits and domes represented in the diagram, Fig. 2. In order to see them the visitor leaves the main cave at a point about three-quarters of a mile within, and passes around the huge block known as the "Giant's Coffin," and follows a winding way leading underneath the main cave.

The "Wooden Bowl" is a small room containing quantities of quartzose gravel, betraying the means by which these excavations were made. Next is the "Side-Saddle Pit," 65 feet deep, as measured by my guide, a colored man, William Garvin, who took along with him a ball of twine for such purposes. The opening is about 25 feet across. Over it, or nearly so, is "Minerva's Dome," 35 feet high. Descending a stairway, a short distance beyond, we enter the "Labyrinth," leading to "Gorin's Dome," formerly estimated to be 500 feet high. But the fact that recent barometrical observations fix the extreme vertical depth cut through the mass of limestone to reach the drainage level in Mammoth Cave at 328 feet, effectually disposes of all such exaggerated estimates. The aperture through which "Gorin's Dome" is seen by the visitor is a sort of window 90 feet above the floor of the dome. The latter can be gained by a side passage. In the floor is a small pit 15 feet deep, leading to a body of water 12 feet deep, making the depth from the window to the lowest point 117 feet. The height of the vault overhead seems to me to be about 100 feet; which gives 217 feet for the extreme altitude of this dome.

Fig. 1

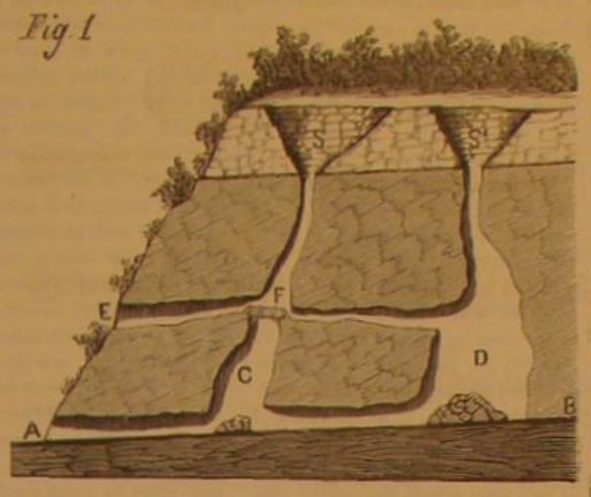


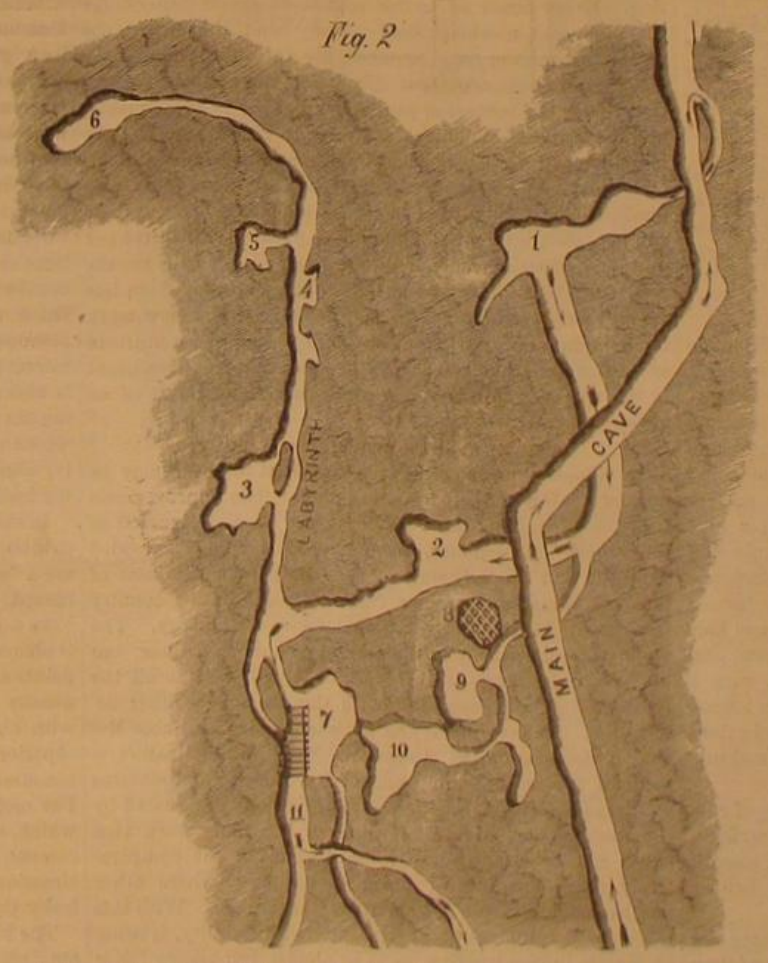
Fig. 1.—VERTICAL SECTION.

There are three or four small domes and pits beyond, indicated in the diagram merely because they belong to the group. One of these has been lately named in honor of Prof. F. W. Putnam, and the other for the writer of this communication.

Returning up the stairway leading out of the "Labyrinth," we next approach a famous chasm, known as the "Bottomless Pit," above which expands "Shelby's Dome." This was long considered an impassable barrier to further progress in the cave, but it is now crossed by a substantial bridge built to the further side from a tongue of rock that juts out into the pit for about 27 feet, seeming to divide the horse-shoe-like chasm into two pits. One of these pits is by exact measurement 95 feet deep, and the other 105 feet deep, although the guides have been accustomed to give much larger figures. "Shelby's Dome" may be about 60 feet high, the space between the pit and dome being 15 feet, thus making the greatest distance from top to bottom about 180 feet.

Most of the localities thus far mentioned have long been open to visitors; but it has been necessary to show their place in the cave, and their relation to each other, in order to an understanding of "Scylla" and "Charybdis," which were found only last winter by the guide, William Garvin, accompanied by Mr. C. T. Hill, and are not yet open to any except the most resolute cave hunters. Indeed I was told by the guide that I was the first visitor who had been permitted to explore this perilous place, though I learn that several have visited it since. The approach is by a low, creeping passage, opening from the arched way, and leading to what has been known—only to be shunned—for many years, namely, the "Covered Pit," a treacherous chasm, imperfectly covered by loose slabs of limestone, between which the black depths seem to be lying in wait for the explorer. After crawling on our hands and knees for some distance, we stopped, and William told me to listen to the slow dripping of water, and throwing a pebble through a low opening on the right, I could hear it bounding from side to side, and after long intervals falling into a body of water at a prodigious distance below. The guide was delighted at my expressions of horror, and repeated the experiment several times. He then challenged me to creep up to the edge and look down. In doing so we lay on a rocky bridge, with the old "Covered Pit" on our right, and the cavity since named "Scylla" on our left. The latter is really a pit within a pit, as we found on throwing lighted rolls of oiled paper down its mouth. The upper pit seemed to be about 90 feet deep, and at its bottom we could just discern the orifice of the lower one. I was anxious to find a point from which we could examine this inner pit to better advantage. Creeping back from off the bridge, and then onward around a rocky pillar, for perhaps forty yards, we came upon the further edge of Scylla, and also found another horrible pit on the left, which, in pursuance of a suggestion from Mr. Klett, the manager of the cave, we named "Charybdis." The dividing ridge at this point was only about six feet wide, between the two chasms, and the classical names chosen seemed to us quite appropriate. Willing to run some risk in pursuit of my object, I clambered a short distance down into "Scylla," to a ledge overhanging its very deepest portion, and cleft by a serpentine crevice about five inches wide. Dropping pebbles through this crack, we could easily time them as they fell, unobstructed, to the bottom of the lowest pit. By repeated trials we determined the time to be exactly five seconds by the watch. This, by a well known formula for calculating accelerated motion, would give 402 feet as the depth *in vacuo*. Making due allowance for the resistance of the atmosphere, and also for the time necessary for the return of the sound, the space passed by the falling pebble was not less than 200 feet, nor more than 250 feet. William, not satisfied with what he may have regarded as scientific guess-work, produced his ball of cord, fastened a lamp to the end of it, and let it down into the darkness. The glimmering light served to show the irregular walls of the abyss, as it descended, until at length it caught on a projecting rock. In his efforts to shake it loose, the guide was so unfortunate as to burn the cord off. The lamp, however, remained where it had lodged, shining on as if determined to do its duty to the last! The part of the cord that was drawn up measured 135 feet, leaving us, after all, to conjecture the remaining depth, our conclusion being that the previous calculation had been near the truth. Probably the limestone is pierced to the drainage level—a distance, according to the barometer, as inspected in the "Arched Way," of about 220 feet.

Fig. 2



1. Wooden Bowl.—2. Side-Saddle Pit.—3. Gorin's Dome.—4. Putnam's Cabinet.—5. Hovey's Cabinet.—6. Ariadne's Grotto.—7. Bottomless Pit.—8. Covered Pit.—9. Scylla.—10. Charybdis.—11. Revelers' Hall.

Fig. 2.—PLAN OF A PART OF MAMMOTH CAVE.

Glad to forsake the thin crust on which we stood, overhanging such depths, we climbed out of the jaws of "Scylla," and made experiments on the depth of "Charybdis." Here again the fragments of stone cast down were five seconds in reaching the pool below. Along the perilous rim William led the way to still another chasm, which he identified as the "Bottomless Pit." Regaining with some difficulty the bridge over it, we proceeded for a short distance on the path that leads to "River Hall," and then turned back by a passage leading under the rocks to an opening in the wall of the "Bottomless Pit," about forty feet below the bridge. Here we saw the famous pit in a new light, and also obtained the only good view to be had of "Shelby's Dome" overhead. While we were standing there I noticed a volume of smoke issuing from a window beyond us. On investigating this phenomenon more closely, we found ourselves looking again into "Charybdis," though not at its deepest part. The smoke came from blue lights we had ignited just before leaving it. On mentioning this fact to Mr. Klett, I was informed by him that he had, on a former occasion, been burning lights in the new pits, and workmen on the bridge had seen them.

Thus, as we have shown, there are, within an area whose diameter does not exceed 600 yards, and may be considerably less than that, six of the largest naturally-formed pits in the known world, besides several others of smaller dimensions; and the entire group is joined together by connecting passages.

On inquiring if there was any sink hole in the vicinity to correspond with such a cluster of chasms, I was directed to

a piece of unbroken forest, less than half a mile from the Mammoth Cave Hotel, where all the requirements of the case seem to be met. This vast depression embraces many acres, and is so deep that, when standing on its edge, one can overlook the tops of the trees growing in the central portion. But it remains to be proved by further exploration whether there are any hidden channels communicating, directly or otherwise, with the remarkable group of domes and pits I have attempted to describe in this article.

AMERICAN INDUSTRIES.—No. 78.

INDUSTRIAL PROGRESS AS REPRESENTED AT THE FIFTIETH EXHIBITION OF THE AMERICAN INSTITUTE.

The popularity of the now constantly recurring fairs in different sections of the country, showing the advancement we are making in the arts and sciences, in mechanics, chemistry, and our multitudinous manufactures, seems to be in no way diminished by their frequency. They are, on the contrary, at once the index and exponent of the activity, enterprise, skill, and inventive genius which are so characteristic of American progress to-day, so that the public is in entire harmony with the spirit they represent, and heartily inclined for a ready appreciation of all which contributes to their interest.

The semi-centennial exhibition of the American Institute, now being held in this city, extends and rounds out what had heretofore been a long and most valuable record of the growth of our manufactures, and the contributions of American inventors and mechanics in furtherance of the march of improvement in all the arts and sciences. It is worthy of its predecessors in all that goes to make such an exhibition not only attractive to mere sightseers, but valuable as an educator, in the means it affords of bringing the public more heartily into sympathy with the spirit of modern scientific investigation, and rendering observers more appreciative of the high degree of excellence which is being reached in all industrial pursuits.

It would be impossible, within the limits of a single article, to make even the briefest allusion to all of the exhibits here shown that are deserving of attentive examination. In the machinery department every inch of space is occupied, and some of the engines working here are models of beauty and symmetry, doing their work so smoothly and noiselessly that one would hardly know they were running were it not from the motion of the belts and shafts and the machines operated. The most interesting exhibit in this department, and one which constantly attracts crowds of visitors, is that of the Brush electric light system, the operation of which, and its thorough efficiency, with a pretty accurate idea of the consumption of power, and the inconsiderable wear and tear, can be readily understood by any visitor with the least possible idea of machinery. Of the *light* itself it is scarcely necessary to speak, all parts of the exhibition being made as bright as though sunlight were streaming in at every window when all of the ninety-six lamps are burning, while half of them make the gas lights look as insignificant as the old-fashioned "tallow dips."

On the first page of this paper we present illustrations of some of the prominent exhibits at the fair. The display of the New York Belting and Packing Company, shown in the large view at the bottom of the page, bears a sign in large letters, with the legend

"RUBBER VS. LEATHER."

It is on the left, as the visitor proceeds from the main aisle of the exhibition building to the machinery annex, where it cannot fail to meet the eyes of all who use belting, and under the sign is inscribed the statement that it would require "one thousand ox hides" to furnish leather sufficient to manufacture the large belts shown. One could readily figure out this for himself by taking the surface measurement and allowing for only the portions of a hide usually taken by leather belt manufacturers, but here would come in the fact that many of the leather belt manufacturers use more of the inferior parts than others, and the further fact that, no two hides being exactly alike, and no one hide being of the same strength or substance in different portions, it would probably trouble the investigator with a mathematical turn of mind as much as it does the leather belt manufacturers themselves, to tell just what selections and measurements to make to obtain even strength and substance in any large belt.

All of this difficulty is avoided in the manufacture of rubber belts, which are sure to be homogeneous throughout, and never before has there been a better display of what it is possible to accomplish in the making of rubber belting than is afforded in this exhibit.

The New York Belting and Packing Company have for many years made this manufacture a leading feature of their business and introduced improvements of the highest value. The great strength of the rubber-coated and impregnated duck used in their belts insures them against any break from a tensile pull twice or three times as great as the best leather will stand; the "stretch" is also taken out completely, the belts being subjected, while under tension, to the action of a powerful hydraulic press, one of the largest of the kind in the world, the bed and platen of which are steam heated, so that the fibers, thus compressed between the hot plates, are set almost as firmly as the particles in a bar of steel; the edges of the belts are firm and smooth, there being practically no joints, and, by a long course of improvements in the composition, they have a hard and tough, almost metallic, surface, but still one of such a nature that these belts always hug the pulley more closely than leather belts.

The contest as to the relative value and efficiency of rubber against leather belts is an old one, but it is one which mechanics and millowners are always interested in, and only those who have seen and used rubber belts of the best quality are qualified to form a correct judgment, for, although there has been a great improvement in the manufacture within a few years, there are still made large quantities of rubber belts of a cheap and inferior quality. In connection with the belting shown in this exhibit are furnished testimonials from some of the prominent users, including many of the great elevator companies, who use the largest sized belts known. These show that in some instances the belts have been used twelve and fifteen years, "without costing a dollar for repair, and still in as good condition as when first set to work." This the company think quite as good a record as can be produced in favor of any leather belting made, notwithstanding the fact that a newspaper in the interest of leather dealers a few months ago quoted as follows from the pamphlet of a leather belt manufacturer: "Buying a rubber, gutta percha, or canvas belt is very much like buying a sickly horse at 33⅓ per cent less than a good healthy one would cost. If such a horse is well groomed, used carefully, left in the stable when sick—when the weather is hot, when cold, when stormy—he may live six months; with extreme care and good luck, one may be able to say that he owns a horse for twelve or eighteen months. Pay 33⅓ per cent more and buy a good healthy one, use him well and kindly, he is always at your service, and can be depended upon. After being in use twelve or fifteen years, he is still good, and, if sold, will bring 33⅓ per cent of his cost. A word to the wise is sufficient." This seems to be a case where the saying that "one story is good until another is told," is particularly in point, and, as the exhibits of both kinds of belting are excellent, those interested will do well to examine for themselves.

Of the other productions of the company, the various kinds of packing, hose, valves, car and wagon springs, mats, gas tubing, etc., make a most interesting display to all who desire to utilize vulcanized rubber fabrics for mechanical purposes. The knot of bicycle tires shown is likewise suggestive, not only of the rapid increase of the demand for these novel steeds, but also of many other uses to which this principle might be applied in rendering cars and other vehicles noiseless and increasing their traction.

The exhibit of Vulcanite Emery Wheels covers a full line of sizes, and embraces the leading grades for fine or coarse work. Only the genuine Wellington Mills emery is used in the manufacture of these wheels, and the company believe they have now attained very near perfection in their production. Every detail as to the best possible constituents for the composition which shall closely bind the emery, the degree of heat and time required for vulcanization, and the mechanical appliances best fitted for the necessary operations, were the subject of prolonged and costly experiments, and the success they have attained is best attested by the large demand for their wheels both at home and abroad. Only just enough rubber is used in their manufacture to bind the emery closely, but they are sufficiently strong to be run at a circumferential velocity of 5,000 to 7,000 feet per minute, and wear evenly, without glazing. Many as are the uses for which emery wheels have been employed in late years, there is hardly a week but develops some new work for them in our factories and machine shops, and a uniform as well as high quality has now become quite as important in this specialty as it is in any other part of the outfit of an artisan.

THE NEW PULSOMETER STEAM PUMP.

An illustration showing this exhibit at the Fair may be seen at the top of the page, to the left. The improvements made in this pump, since which it has been designated as the "new" pulsometer, have caused a widely extended demand, and are bringing to the company encomiums of the most valuable character from all parts of the country from users in almost every department of industry. The variety of pumps now in the market is almost endless, but the new pulsometer is this year on exhibition at all the leading fairs, in competition with those of every other description. At the Fair of the Massachusetts Charitable Mechanic Association, in Boston, where a leading feature is made of the working of pumps for a variety of fountains and large reservoirs, this pump was especially designated by the management to do a portion of the daily work that could not be dispensed with, on account of the comparatively small quantity of steam it required, where other pumps made too large a drain upon the boilers. With this efficiency it combines great strength and durability, it being so simple in construction as to be almost impossible for it to get out of order.

The quickness with which this pump may be set up and put in operation in any locality is, aside from the great amount of work it will do, one of its most valuable recommendations. It is connected at the top with a steam supply pipe, and at the bottom with the suction pipe, the discharge pipe leading from the discharge chamber. It works with a vacuum and with direct steam pressure in two chambers alternately, the operation being so nicely regulated by a well-fitting ball valve that the pumping proceeds steadily and almost noiselessly, like the regular beating of a pulse, from which the pump has its name and registered trademark. In working, the steam enters the chamber directly above the water, pressing upon and forcing it out through the discharge valve with a force proportionate to the steam pressure; when the water has been displaced by the steam, which follows it to the opening of the discharge chamber, the steam suddenly condenses, leaving a vacuum, which is at once filled from the suction pipe.

Among the striking testimonials which the company have this year received as to the efficiency of their pump was one which came from the Michigan Coal Company, who had a "cave-in" at their mine at Jackson, in that State. The shaft was 85 feet deep, and the water on four to five acres at the bottom was said to average five feet in depth; they testify that the water was lowered by a No. 9 pulsometer pump at the rate of twenty-three inches per hour. Numerous other testimonials are also furnished showing their efficiency for mining, railroad, and steamboat use, for all kinds of manufactures, for draining quarries and cellars, and for irrigation, and in Europe as well as in this country.

These pumps are made of brass or other metal for pumping liquids destructive to iron, with lead for acids, bronze for sugar works, and special composition or wood valves for other purposes. They are manufactured and sold by the Pulsometer Steam Pump Company, 83 John street, New York, Wm. F. Kidder being president of the company, G. F. Badger, secretary, and Geo. W. Laird, treasurer.

ASBESTOS PRODUCTS FOR ROOFING, BOILER AND PIPE COVERINGS, PACKING, PAINTS, ETC.

One of the first exhibits to attract the eye, at the right as you enter, is that of the H. W. Johns Manufacturing Company, which we illustrate in one of the views at the top of the page. Here are arranged a selection of their varied productions, including asbestos roofing, boiler coverings, lining felt, steam rope wick, and flat packing, millboard, gaskets, sheathings, cements, etc., with their liquid paints in a great variety of packages. The display is a more tasteful one than it would be supposed could be readily made from this homely yet highly utilitarian product, and cannot fail to interest millowners and steam users generally, as well as those who study economy and good service in either interior or exterior painting.

The variety of purposes for which asbestos has been made available within the comparatively few years since its valuable properties have become known, and practicable methods of working it perfected, would be somewhat remarkable, were it not simply a repetition of our experience in the uses so rapidly found for other natural products when skill and inventive genius first adapt them to meeting acknowledged wants of the public. This silk-like and really fine-fibered mineral has, through the agency of Mr. Johns himself, who first commenced its utilization in 1858, become a most invaluable agent for many mechanical purposes, besides meeting a multitude of wants of architects and builders in a way that at once increases the durability and lessens the cost in a great variety of structures. In its use for roofing, for instance, for which it was first adapted, its great economy over the expensive materials previously thought necessary, while it at the same time made a tight roof needing but little repair after years of wear, at once gave it an extensive demand. The appearance of these goods is familiar to all, it being furnished in rolls about forty inches wide, of any desired length, so as to make a light covering, and one very quickly put on; it consists of a manila lining, upon which is a layer of waterproof composition, then a strong canvas, another layer of waterproof composition, and a surface layer of asbestos coated felt. In connection with this roofing fabric, an asbestos roof coating is also manufactured for prolonging the service and keeping the roof in good order, also a white fireproof coating, which makes the roof air and water tight, forming an effective non-conductor for protection against fire from adjoining buildings.

In the paints, which form a conspicuous portion of the exhibit, besides the asbestos fireproof paints and coatings are a full line of fine linseed oil paints, in liquid form, the company designating their productions in this line, which have now become very extensive, with the well known trademark which distinguishes all their goods. These paints are ground and mixed differently from the processes usually followed, and are not intended to compete in price with cheap goods in this line, but are claimed to have superior durability, and therefore more economical to the consumer, than white lead and other paints in common use. For roof painting the company have a special preparation, which, either alone or in combination with their asbestos cement, they recommend for rough usage and in exposed situations, and also for the preservation and repair of old leaky tin and other roofs.

The styles of coverings for hot air and steam pipes, boilers, etc., preventing the radiation of heat and economizing fuel, are shown in great variety. The company have patents on many different combinations and ways of using asbestos for this purpose, but for pipe coverings they recommend their asbestos lining felt—a pure asbestos sheathing, to one side of which is attached "flocked" asbestos. This comes in sheets and rolls, and makes an insulating cushion or non-conducting lining, over which is placed a layer of hair felt and then one of non-porous fireproof sheathing. For boiler coverings, or where large surfaces are to be protected, the company recommend a special production called asbestos cement felting, partaking of the nature of a felt and a cement. There is sufficient strength and flexibility to the asbestos fiber to prevent the cracking of such a covering from the expansion and contraction of boilers due to varia-

ble degrees of heat, and its indestructible nature gives it great permanence.

Besides the above, there are numerous other productions in the exhibit into which asbestos enters more or less largely, and a great variety of specimens of the natural asbestos, but it is difficult to make the common run of visitors believe these goods are manufactured from such a natural product. A great deal of attention is given to a little illustration in the exhibit showing the indestructibility of asbestos by heat, an Argand gas jet being kept constantly burning, over which is fixed a handful of asbestos fiber, but the hot flame is seen to have no effect whatever on it, a result which surprises not a few of those who take these fine textured shreds to be of silk or some such fiber.

Mr. Johns is the inventor and patentee of the methods and processes by which all the products here exhibited are manufactured, being the originator in the application of asbestos for these modern uses, and for its combination and employment in every way heretofore found practicable. The New York office of the company is at No. 87 Maiden Lane, where illustrated catalogues, descriptive of their inventions, can be obtained, and their goods are sold by dealers in all the principal cities and towns in this country and abroad.

THE ALMOND COUPLING,

an interesting mechanical device, which attracts much attention, is shown in one of the small views. It furnishes a substitute for bevel gears and the quarter turn belt to allow of shafting to be run in any desired direction.

GAS STOVES

are shown in great variety at the exhibition, by manufacturers of stoves, meters, and heating apparatus generally, and our artist gives a sketch of one of the most noticeable of these, showing how to "put the kettle on," etc.

STEAM BOILER NOTES.

The London *Iron Trade Exchange* has the prospectus of a new steam boiler insurance company, incorporated under the name of the Scottish Boiler Insurance and Engine Inspection Company. The liability of shareholders is limited to the number of shares held by them. Their principal office is to be at Glasgow; their capital, £50,000, in 10,000 shares. Subscribers are required to pay five shillings per share on application, five on allotment, and ten shillings at the expiration of three months from the registration of the company. The other £4 are not to be called for, but remain a reserve fund for the security of insurers. It shows that steam boiler insurance is profitable, by quoting from the "Stock Exchange Year Book," the business of three other stock companies in England, none of which have ever been called on for their reserve, which is about the same percentage of the par value as that proposed by the new company, while their dividends have been from ten to twenty per cent per annum, with occasional bonuses varying from two to five shillings per share. It claims that there are in Scotland about 25,000 boilers, and only 9,000 to 11,000 of them insured. The *Trade Exchange* says:

"The business of the company is to insure boilers against explosion or collapse, and the periodical inspection of both engines and boilers, the testing of new boilers by hydraulic pressure, the superintendence of the erection of new engines, and the repairs of those in use, also to advise policyholders generally in matters relating to their engines and boilers. The system of boiler insurance and inspection inaugurated by a Manchester company, eight years since, has been eminently successful. It met the need of steam-power users of competent periodical inspection of their boilers without entailing great expense. By the system of boiler insurance the steam-power user is relieved of all anxiety as to the condition of his boilers; he could not effect a policy unless the plant was in safe working order, and, the policy once effected, the insurance company will, by careful and periodical inspection, see that the condition of the boilers is kept up. The destruction of life is rightly the most dreaded calamity in connection with a boiler explosion, and we feel satisfied that the Manchester Boiler Insurance Company, the Wolverhampton Company, and others have been the means of saving many lives by their insurance inspections. The Scottish Boiler Insurance and Engine Inspection Company is founded to insure and inspect boilers in Scotland, and, looking at the immense number of steam-power users north of the Tweed, there is certainly a wide and useful field for its business."

The boiler of a train on the Hastings and Dakota division on the M. and St. Paul Railway exploded, September 26, near Prior Lake, while running fifteen miles an hour. The engine was thrown 150 feet forward and off the track, two cars being derailed. Engineer Grove Bradbury was thrown a considerable distance and died soon after. The fireman and conductor Jones were slightly injured. No passengers were hurt, and they were sent to their destination on a special train.

Under the provisions of the new boiler inspection ordinance of Detroit, Mich., which has already gone into effect, all persons desiring a license must file an application with the inspector, William Wray, stating their experience and qualifications, and having the indorsement of at least two well-known citizens as to their temperate habits and good character. The inspector will then examine the applicants as to their qualifications, and report the names of such persons as he deems competent to the mayor, who will issue the license when the necessary bond is executed and the stipulated fees paid into the city treasury.

By the explosion of a boiler, late in September, near Uniontown, Pa., James McDonough was fatally scalded and four others injured. The cause was the use of sulphur water during the drought. This cause of boiler explosions has been before alleged, and was commented on in these notes under date of October 1. It is probable sulphur had less to do with the explosion than the announcement of its use seems to indicate.

The St. Louis *Age of Steel* says: "A Canadian mechanical engineer named Arnoldi has invented a device designed to give a partial security against boiler explosions. The invention consists of an electric adjustable attachment to the ordinary steam gauge now in use, to give an instant and continuous alarm, at any distance from the boilers or other pressure generators, of any excess of pressure over that at which the alarm has been set, and where there is more than one generator in operation, an ordinary 'tell tale' can be attached to signify which generator is at fault. The invention possesses a great many valuable features, prominent among which may be noticed that it is extremely simple and inexpensive, and can be attached to existing arrangements at no expense beyond that of the alarm itself, and without in anyway affecting the present adjustment of the gauge."

This apparatus might be made very useful if placed beyond the reach of the boiler attendant, and connected by wire with the residence of the superintendent or owner of the boiler. It would, at night especially, tend to keep a watchman on the alert who might otherwise coal up the fires for a good rest, go to take a smoke or a nap when he should be attending to his duties. It would be an easy matter, however, for a rogue to disconnect the wire and thus defeat the object of the device.

IMPROVED WINDOW CHAIR.

The many accidents to life and limb of persons engaged in window cleaning or doing other work about the windows of our high dwellings calls for a safe support for persons

NEW WINDOW CHAIR.

doing such work. The patent window-cleaning chair, shown in the engraving, is designed to supply this want. It not only affords a safe and comfortable seat for females who are often obliged to risk their necks at this work, but it is also a strong and safe platform for men to stand on to paint, glaze, put up awnings or decorations, or do other work about windows. It holds cups for the necessary water and cloths to clean with. It is provided with supports for paint and brushes, and it will be found very desirable to those who wish to work quickly and safely, as well as a protection and safeguard to those who are timid and nervous while working in elevated places. The window chair is fastened and detached in less than a minute, and, in addition to the uses already mentioned, it will be found very agreeable to sit upon when it is desirable to obtain a breath of fresh outside air; sitting on it comfortably the cool breeze can be enjoyed without leaving the room. The construction of the chair is very simple, and so light that a child can carry it. It folds up like a book and stores away in a very small space. It will fit any ordinary sized window, and is provided with a step which permits of reaching the highest parts of the window, and the work of cleaning can be done without the aid of a step ladder. The window-cleaning chair can be seen at the Inventors' Institute, corner of Third and Fourth Avenues, Seventh and Eighth streets.

Oysters in New Orleans.

The coast of Louisiana abounds in oyster banks, and a considerable oyster trade has been developed at New Orleans, giving employment to about 200 luggers, each manned by from three to six men. The owner is usually captain, and receives two shares of the net proceeds of the sale of the oysters, one being claimed by the boat and one for himself. Every man on board then receives a share each in payment for his services, from which he has to pay his board or for his share of the expense incurred in the purchase of provisions. A trip usually consumes from four to seven days.

The oysters are taken by tonging. During the summer and early fall the supply is for the most part the small and watery "raccoon" or basin oysters, from Saline Bay, Grand Isle, and Barataria Bay. The price ranges from $1.25 to $3.00 a barrel. A better quality is received later from Bayou Cook. These oysters have been transplanted during the summer from Saline Bay and natural beds elsewhere, and are fatter and better flavored than the natives. Bayou Cook oysters fetch from $2.50 to $4.00 a barrel. Owing to the shortness of the orange crop this year a large number of fruit luggers will be transferred to the oyster traffic. The wholesale oyster houses in New Orleans give employment to upwards of 500 hands.

Gold in New York.

The Albany correspondent of the *World* finds that 737 persons have filed claims for 597 localities in the State of New York said to contain gold and silver. Some of these claims are explained by the fact that, to forestall other possible claimants, the owners of lands have filed claims for mineral veins, or suspected veins, without much regard for their intrinsic value. Most of the claimants, however, appear to believe that their discoveries are important; and it would also seem that, to a considerable extent, the claimants are not very well qualified to judge of the probable character and value of mineral deposits.

The correspondent cites a number of claims to illustrate the extraordinary ignorance of metallurgy shown by some of the would be miners. One locator claims the possession of a ledge yielding gold, silver, platinum, iron, tin, lead, and graphite—truly a curious, not to say wonderful, conglomeration. Another says that his claim is one-fourth pure silver—rich ore, as any Western man would tell him. And yet another locator states that his ledges, of which he has thirteen, contain gold as good as that placed upon Solomon's temple. He says, however, with exceeding *naiveté*, "I have not found any yet."

The position of the claims shows four well defined gold fields. The first begins somewhat about Plattsburg, and runs in a southerly direction into the counties of Hamilton, Fulton, and Saratoga. It then divides into two branches, going west into Herkimer and east into Washington County. The second is south of this, in the neighborhood of Dutchess County. The third is still further, south in Westchester and Rockland counties. The fourth is in the western part of the State, in Erie and Allegany counties. From the fact that the Geological Survey has not yet made any examination of these alleged gold fields, it can only be said in a general way that quartz is known to exist in the neighborhoods where these gold and silver veins are said to be. It is therefore impossible, without examination, to say how much basis there is for the faith shown by the locators. In a few instances the notices filed in the office of the Secretary of State contain statements of assays made and work done, but these are not enough to found a judgment upon as, to whether these gold fields will commercially pay. They simply indicate that the locators have, in some instances, proved their faith by their works. One of them records the discovery of a blind lead, or lead of which there were no surface indications of gold, while sinking a shaft on a silver vein. As the gold lead was discovered at a depth of fifty odd feet, the notice shows some considerable work done.

The Largest Elevator in the World.

The new elevator built by David Dows & Co., in Brooklyn, is said to be the largest in the country, and probably the largest in the world. It has 100 feet front upon Columbia street, and extends thence 1,200 feet to the river, 600 feet being occupied by the main building, which is of brick, and 600 feet by a frame extension, which is sheathed with tin. The frame building is 45 feet high, and has a tower in its center 100 feet high from the wharf level. The brick building is 85 feet high, and has an elevator tower in the northeast portion 120 feet high. Three towers rise from the center line of the main building, about 100 feet from each other. Each tower is 175 feet high. Solid brick walls divide the main building into nine apartments, closed to each other, except where there are openings for the belting to pass through. These walls form a bulwark against fire, as the holes can be closed by dropping a cast iron door over them, and if the fire should be so fierce as to cut off access to these doors they are so arranged that the ropes may be burned quickly, thus permitting them to drop of their own weight. An electric fire and burglar alarm is furnished for the building.

The machinery in the elevator can take grain at the rate of 8,000 bushels an hour from the barges or vessels at the pier. The grain is elevated, sifted and fanned, weighed, stored, put in bins, and then transferred to vessels at the pier. There is nearly a mile of wire cable used to transfer the steam power, and about five miles of belting, called conveyers, carry the grain up with railroad speed. These conveyers travel at the rate of 600 feet a minute, and carry to its destination 2½ bushels of grain a minute. No shoveling is necessary.

NEW INVENTIONS.

Mr. Lester Low, of Ryegate, Vt., has patented an improvement in carpenter's squares, which consists, first, of a square provided with crenelations or notches along one or more of its edges, arranged to coincide with its graduations.

Mr. Randolph P. Cory, of Union City, Ind., has patented an improvement in that class of revolving firearms in which a chambered cylinder is adapted to slide as well as revolve on a horizontal axis and is forced up against the barrel just previous to each discharge.

Mr. George T. Hedrick, of Weaverton, Ky., has patented an improvement in bag stoppers, which consists of a short solid cylinder or disk, externally flanged at top and bottom, with a central circular groove between the flanges, to receive the upper end of the bag and its drawing string, the lower flange being provided with two or more holes for attaching one side of the stopper to the bag, so as to be swung outside of the bag and out of the way of the grain in filling a bag or emptying it.

Mr. George Cressey, of 175 Third St., Louisville, Ky., has patented an electric water meter register. The object of this invention is to provide a practical and reliable means for registering the amount of water passed through a meter. The invention consists, principally, in combining an electro-magnetic register, a battery, and a circuit wire with a water meter, which circuit wire enters the meter, and through proper insulations and contact faces makes and breaks the current at every impulse of the piston or other working part of the meter without the necessity for a stem or any other movable part operating through the meter case

IMPROVED GOVERNOR.

We give an engraving of an improved governor recently patented by Mr. Joseph H. Stombs, of La Crosse, Wis. This governor is of the class in which an auxiliary weight is used in connection with the customary governor balls, the weight engaging with the stem of the governor valve and serving as a means for controlling the action of the valve, to make it more sensitive.

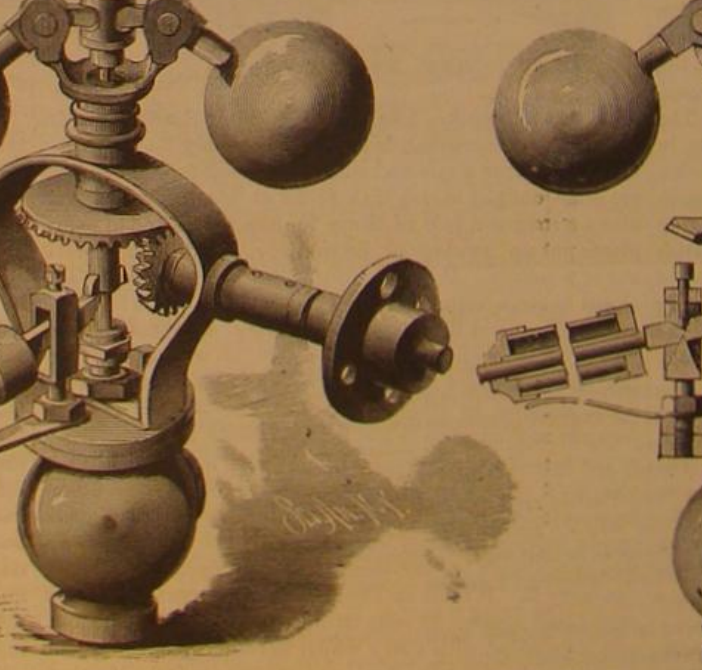
The improvement consists in a cylindrical shell of glass provided with detachable heads having a central tube, which passes through the cylindrical shell and receives the stem or long arm of a lever fulcrumed in a block or support carried by the base plate of the governor frame. The cylinder is movable on the lever, and is half filled with a suitable liquid. The short arm of the lever engages the valve stem The lever rests upon a knife-edged fulcrum.

The governor stem carries the customary bevel wheel, into which meshes a bevel wheel on the governor driving shaft. The stem is loosely fitted in an encircling sleeve, which receives the inner ends of the arms carrying the governor balls.

A collar secured to the stem below the sleeve serves to form a temporary connection between the governor balls and the valve stem when said balls are thrown in an outward direction by centrifugal force, tending to close the valve. The governor stem is surmounted by a ball, which causes the stem to slide through the frame and bevel wheel when the governor balls drop by reason of the breakage or stoppage of the driving mechanism. It necessarily follows that the downward movement of the stem facilitated by the weight will cause the governor valve to close and instantaneously arrest the flow of steam to the engine.

The sleeve below the bevel wheel, which connects the valve rod with the governor stem, has a transverse pin carrying wedge-shaped blocks at its ends. The face of the sleeve adjoining the end of the weight lever has a recess, which forms a seat for the wedge-shaped block.

It will be apparent that when the thin end of the block is turned in a downward direction the end of the weight lever will remain engaged therewith during the ordinary movements of the governor balls; but when the latter have assumed their lowest position the end of the lever will glide off from the block, so as to disengage it from the valve and governor stems, which will permit the valve to close by means of the independently movable governor stem. By placing the thick edge of the block down, the parts are so set that the lever cannot become disengaged from the valve and governor stems. The lever is only to be used in this last described manner when the motor is being "shut down." When the stop motion is on, which is the case when the thin end of the wedge-shaped block faces in a downward direction, the regulator or weighted lever will be unshipped in the manner already described, and in dropping down it falls upon a spring, which breaks the fall of said lever. In the ordinary working of the governor the center of gravity of the weighted lever is shifted with every upward and downward movement of the lever, making the governor more sensitive than it could be with a fixed weight on the lever.



STOMBS' GOVERNOR.

NEW DIVING APPARATUS.

In diving apparatus shaped to the human body it has been difficult to combine with the requisite flexibility of material a rigidity sufficient to resist at every portion of the armor the external pressure of the water without re-enforcing or aiding the material of which the apparatus is composed by pumping within it a supply of atmospheric air not only sufficient to insure life to the diver, but also sufficient to balance the external pressure of the water.

The armor, shown in the engraving, overcomes this difficulty, and is of itself of sufficient strength to resist at its every portion the external pressures without re-enforcement by an oversupply of internal air, and is at the same time sufficiently flexible to permit of the movement of the diver.

TASKER'S IMPROVED DIVING APPARATUS.

The flexible waterproof covering of the armor is made of rubber, water-proof cloth, or other fabric, which, while both strong and elastic, is impervious to water.

An interior metallic casing constitutes the inner layer, or body of the suit. The lining has rigidity sufficient to retain the contour of its various sections against the collapsing pressure of the water.

The joints corresponding to the joints of the limbs are of bellows form, permitting of the free movement of the body and limbs. The joints are stayed so as to prevent collapse from external pressure, as shown in the sectional view, Fig. 2.

It is obvious that this joint has the advantage of being laterally very stiff, compact, and light, a few rings cut from light sheet metal insuring, from their form and arrangement, both strong resistance to exterior pressures and large extension to the flaps. The flap portions are thoroughly protected by the rings when closed, and held with certainty in their folds, while the connection of section with section is steady and strong, whether the joint be open or shut. The apparatus, therefore, considered as a whole, is a casing at all parts, joints, and unjointed surfaces, capable of resisting external pressures.

The trunk portion of the apparatus is provided with a coupling, which starts from one shoulder, extends obliquely around the body, front and back, and terminates below the arm which is opposite to the shoulder mentioned, so that the apparatus can be easily put on and taken off.

The helmet of the apparatus, shown in section in Fig. 3, is adapted to be removed.

The air tubes consist of an inner tube for supplying air, and an outer tube for carrying off the exhaled air. These tubes are made to resist a high degree of external pressure and to have a tensile strength sufficient for raising and lowering the apparatus.

This new diving apparatus is the invention of Mr. Stephen P. M. Tasker, of Philadelphia, Pa.

Charles A. Spencer.

For many years the little town of Canastota, N. Y., has been known to scientific men the world over as the source of the most perfect and efficient microscopic lenses to be found. Their maker, Charles A. Spencer, died recently, at the age of sixty-eight, in Geneva, N. Y., whither he removed five or six years ago. With all his genius and skill, Mr. Spencer had none of the traits of a money-maker, and his whole life was troubled by poverty due very largely to his inability to carry on a business by business methods. His great difficulty apparently was that he never reconciled himself to the idea of spending his life as a mechanic, though in his sphere the best mechanic in the world, and so devoted to classical and other studies time that should have been devoted to the business interests of a calling for which he was pre eminently adapted.

An intimate friend says of him in a communication to the Utica *Herald:* "At an early day he acquired a reputation which opened the broadest market for his glasses and instruments, but the trouble was his tardiness in filling orders. He would suffer none to go from his shop until tested by him and found perfect, and to do this he would take time, and that discouraged patrons. I have been shown by Mr. Spencer unfilled orders on hand at one time, from all parts of the country and from Europe, amounting to from $20,000 to $25,000, or more. One of the first great triumphs of Mr. Spencer was in the discovery of the markings on a specimen of the *naviculacea*, an infusoria of the waters of the Hudson, sent to him as a test object by Prof. Bailey, of West Point. The professor had a microscope of the last make of Ross, of London, that defined the longitudinal lines of that infinitesimal object, and he thought Spencer's glass would not exhibit them. On applying it Mr. Spencer found not only these, but much finer transverse lines, plainly marked, quite to the confusion and astonishment of the professor. That triumph soon went through Europe, and that test object took the name to this day of the *Navicula Spencerii*. Ross, the celebrated scientist and optical instrument maker of London, set the limits to the powers of glasses. Spencer at an early day far transcended those limits, confounding the most learned in Europe. A professor in the university of Dublin reported to that university the fact of that triumph as having been accomplished by a 'young man of the western forest,' to his surprise and great pleasure. Thus did he invade the old and long obscured formulas, and strike off in a line overthrowing all and leading to such perfection."

The detection of the imperfect adjustment of the great telescope at Washington, after it had been many years in use, characteristically illustrates the acuteness of Mr. Spencer's perception in such matters. Observing that the instrument was not adjusted so as to display its full powers, he

expressed a desire to fix it. It was thought by Profs. Henry, Maury, and others that the experienced men who had known and used the instrument for years understood it; and they hesitated to allow so young a man to meddle with it. But they finally consented, and after he had manipulated it a short time it displayed powers before unknown, to their great and happy surprise.

Mr. Spencer's rare ability was much appreciated, especially in Europe; and many honors were paid him by scientific men and societies. At the Paris Universal Exposition of 1878 his lenses were awarded a gold medal.

Eider Duck Farms and Feathers.

The *Herald's* correspondent with the United States steamer Alliance gives an interesting account of one of Iceland's peculiar industries. By a long and rigid enforcement of a law against the use of firearms within hearing of the resorts of eider duck, these ducks congregate in vast numbers. The owners of most of the duck farms are engaged in fishing, and all the refuse of the codfish dressed on the islands is thrown out on the water for the ducks to eat. Some of the farmers have lately retired from the codfishing, which in the vicinity of Reykjavik is no longer good; but still the ducks come and build their nests, but not in such great numbers as before. When one sees the treatment the birds get their annual return is strange and unaccountable, for they are systematically robbed by the island owners. In the spring, when the ducks swarm here to search out places between the rocks to build nests in, they, having selected a suitable site, pluck the down from their breasts—that soft, silky down famous the world over as the warmest and softest of coverings. Felt between the fingers it resembles floss silk, it is so soft, and it is as springy as rubber. A great bulk of it can be compressed into an incredibly small space, and when released after a long time it resumes its original size. This first plucking is very abundant, for the bird is preparing for warm weather and is prodigal of its thick under-plumage. The first nest is stolen by the farmers, and the bird, finding it gone, finds still enough down upon its breast to construct another, which in turn is taken like the first. The supply of down on the female is now exhausted, and she calls on the drake, and from his down the nest in which the eggs are hatched is made. In case this nest should be taken the bird seeks another nest-hiding place.

When taken from the nest the down is full of straw, chips, bits of moss, and wads of lichen, and must be cleaned before it is fit for use. The machine used in the process of cleaning is of the most primitive kind, and consists of a sort of harp made of coarse strings of raw seal hide, over which the nest is rubbed. In this operation the dust is driven out, and the room in which it is performed is as cloudy as the carding room of an old oakum walk. The chips of straw, moss, and lichen fall through, and only the down remains under the rubbing hand of the operator. Even in the matter of eider down there is a discrepancy between the real thing and the received notions about it. I have seen eider down presented for sale in New York which was pure white, while the real article is a dark slate color, and when viewed at a distance looks not unlike the fur of the blue fox. There is eider down and eider down. There is eider down taken from birds that have been killed in the far north, there is eider down half from killed birds and half from robbed nests, and there is eider (?) down taken from geese in Long Island and New Jersey and sold to other members of the family in New York. The down from dead birds or even the mixed down is without the virtue of the nest-robbed article, and there is so much adulteration practiced in the business that, even in Iceland, you are liable to be imposed on if you don't purchase from the farmer direct. Iceland down is a special grade in the market and brings better prices than any other at the annual auction held for its sale at Copenhagen. The supply from Iceland is very limited, and only amounts to 7,000 pounds per year.

BREAKFAST SET OF SEVRES PORCELAIN.

The accompanying engraving represents an elegant breakfast set of porcelain from the works at Sèvres, France. It is something to be coveted by every lover of fine things in porcelain. The design and ornamentation show so well in the engraving that no description is necessary.

BREAKFAST SET OF SEVRES PORCELAIN, FOUR-NINTHS ACTUAL SIZE.

Hunting Alligators in Florida.

Parties are hunting the 'gators way down on the Caloosahatchie and Kissimmee rivers, and upon the numerous lakes in that region. Nothing is used except the skins upon the belly and legs, the rough, scaly plates upon the backs of the animals being rejected. The heads are cut off and buried for a few days, until the tusks can be detached. It was announced some days since that one person had collected alligator teeth to the amount of three hundred and fifty pounds. This fact alone will give some idea of the destruction now going on among these creatures. On the St. John's River a new method has been devised for the successful pursuit of this game. A dark lantern with a powerful reflector is used on suitable nights, and no difficulty is experienced in approaching the quarry. The animals appear to be perfectly bewildered by the strong glare, and make no effort to escape. The gun is held within a few feet of the head, a touch to the trigger, and there is a 'gator less in Florida. This new process is very effective, as the hunters are enabled not only to kill but to secure the prey. It is sad to reflect that the race of the saurians is in danger of being extirpated. Thousands are slain annually by tourists and others for amusement merely, in addition to those slaughtered for profit.

Thousands of baby 'gators are stuffed as specimens or sent off alive as curiosities, while myriads of eggs are blown and disposed of by dealers. Amid all these causes combined the brute seems in a good way to become extinct. This is somewhat unfortunate, as the beast is a constant source of interest to our Northern brethren, and every hunter from that section eagerly craves the distinction of adding an alligator scalp to his list of trophies. If their wholesale destruction continues it will be necessary to call on the Fish Commissioners to restock our lakes and rivers with these valuable animals.—*Jacksonville Cor. Savannah News.*

Kind Treatment of Horses.

It has been observed by experienced horse trainers that naturally vicious horses are rare, and that among those that are properly trained and kindly treated when colts they are the exception.

It is superfluous to say that a gentle and docile horse is always the more valuable, other qualities being equal, and it is almost obvious that gentle treatment tends to develop this admirable quality in the horse as well as in the human species, while harsh treatment has the contrary tendency. Horses have been trained so as to be entirely governed by the words of his driver, and they will obey and perform their simple but important duties with as much alacrity as the child obeys the direction of the parent.

It is true that all horses are not equally intelligent and tractable, but it is probable that there is less difference among them in this regard than there is among his human masters, since there are many incitements and ambitions among men that do not affect animals.

The horse learns to know and to have confidence in a gentle driver, and soon discovers how to secure for himself that which he desires, and to understand his surroundings and his duties. The tone, volume, and inflection of his master's voice indicate much, perhaps more than the words that are spoken. Soothing tones rather than words calm him if excited by fear or anger, and angry and excited tones tend to excite or anger him. In short, bad masters make bad horses.

REWARD FOR AN ANTIDOTE TO YELLOW FEVER.—According to the *Eco del Comercio*, the legislature of the State of Vera Cruz offers a prize of $100,000 to him who shall present a true antidote for all kinds of vomiting.

BOTANICAL NOTES.

Milkweed as an Insect Intoxicant.—A writer in the *Pharmaceutical Journal*, speaking of a visit to Kew Gardens, says: "It is amusing to see the numbers of bees hanging on the sweet-scented flowers of *Asclepias cornuti* (milkweed) perfectly intoxicated, so that they will not move even when roughly touched, one being noticed by the writer to be apparently 'dead drunk' on the ground. The numerous bees which visited the flowers of the teasel seemed to be similarly affected. It would be interesting to learn whether the flowers of the *Asclepias*, which are known to contain a sort of sugar, really do possess an intoxicating principle, since the soma plant of India, alluded to in the Sanskrit Vedas (which some place as far back as twenty centuries B.C.), and the juice of which yielded, by fermentation, an intoxicating liquor, is supposed to be a species of *Asclepias*." The milkweed must have acquired these intoxicating properties through change of soil and climate, since we are positive that they do not exist in the plant in this its native country. We have watched bees gathering nectar from the flowers many a time, but we never observed that it had any intoxicating effect upon them; and we do not believe that any one has observed such a fact here.

How the Seed Buries Itself in the Ground.—A paper on this subject was read at the recent meeting of the British Association by Sir John Lubbock. One of the most interesting parts in botany, he said, was the consideration of the reasons which led to the different forms, colors, and structures of seeds, and it was, he thought, pretty well made out that a large proportion of those might be accounted for either as serving to protect the seed or to assist in its conveyance to a place suitable for its growth. If the seeds of trees fell directly to the ground it was obvious that very few of them would have a chance of growing. It was an advantage to them, therefore, of which many availed themselves, to throw out wings, in consequence of which the wind wafted them to a greater or less distance. Others were transported by animals, and others again were thrown to a great distance by beautiful and wonderful contrivances in the plant. Some were enabled to penetrate the earth, and others sow themselves in the ground. In one of the clovers (*Trifolium subterraneum*), after the flower had faded, it turned downward and buried itself in the ground. The ground-nut of the West Indies, and more than one species of vetch, had the same habit. In the *Erodiums*, or crane's-bills, the fruit is a capsule, which opens elastically, and sometimes threw seeds to some little distance. The seeds themselves were in some cases spindle-shaped, hairy, and produced into a twisted awn. The number of turns on the awn depended upon the amount of moisture. If a seed be laid upon the ground it remained quiet as long as it was dry, but as soon as it was moistened the outer side of the awn contracted and the hairs surrounding the seed moved outward, the result of which was to raise the seed into an upright position. The awn then gradually unrolled, consequently elongating itself upward, with the result that if it was entangled among any of the surrounding herbage the seed was forced into the ground. A still more remarkable case was that of *Stipa pennata*, the seed of which was small, with a sharp point, and with stiff short hairs pointing backward. The upper end of the seed was continued into a fine twisted rod; then came a plain cylindrical portion attached at an angle to the corkscrew, and ending in a long and beautiful feather—the whole being about a foot in length. That end was supposed by Mr. Francis Darwin to act very much in the same manner as that of *Erodium*. Mr. Lubbock did not doubt that the end would bury itself in the manner described by Mr. Darwin, but he doubted whether it always did so. One fine day, not long ago, he chanced to be looking at a plant of that species, and around it were several seeds more or less firmly buried in the ground. There was a little wind blowing at the time, and it struck him that the long-feathering awn was admirably adapted to catch the wind, while, on the other hand, it seemed almost too delicate to drive the seed into the ground, as described by Mr. Darwin. He therefore took a seed and placed it upright on the turf. The day was perfectly fine, and there could therefore be no question of hygroscopic action. Nevertheless, when he returned in a few hours, he found that the seed had buried itself some little distance in the ground. He repeated the observation several times, always with the same result, thus convincing himself that one method, at any rate, by which seeds bury themselves is by taking advantage of the action of the wind, and that the twisted position of the awn, by its corkscrew-like movement, facilitates the entry of the seed into the ground.

Effect of Pressure on Seed Germination.—In a note communicated to *Nature* by Mr. W. Carter, an account is given of the effect of pressure on the germination of seeds. He found that under a pressure of two and a half atmospheres mustard seed germinated twenty-five hours earlier than under the ordinary pressure of the atmosphere; but that the early development became permanently arrested during the eight days of the experiment, and the cotyledons of one that had escaped entirely from the seed coat remained as etiolated as if grown in absolute darkness, while those under ordinary pressure grew rapidly, and their cotyledons became of a deep green color. The etiolated plants, when removed from the pressure, rapidly grew into vigorous young plants. An increased pressure would, therefore, seem to stimulate germination and prevent the formation of chlorophyl. The pressure was obtained by the use of a column of mercury. The seeds were sown on moist cotton-wool, placed in a small bottle, which was then secured to the curved extremity of a glass tube, into the long arm of which mercury was poured until it reached a height of 45 inches above the level of the metal in the short arm.

Poisoning by Carbonic Acid.

It is our painful duty to have to record from time to time fatal accidents in breweries arising from want of ordinary precautions being taken before men are allowed to descend into wells or fermenting vats. In wells there is always a natural evolution of carbonic acid gas, both from the water at the bottom of the well, and from fissures in the rock into which the well is bored. In fermenting vats carbonic acid accumulates from the fermentation which has taken place in them, and even when the wort has been all drawn off, the gas will remain in the vat unless precautions are taken to remove or disperse it. In spite of its high specific gravity and the well known law of diffusion, carbonic acid gas will remain at the bottom of a closed vessel for a considerable period. It has been asserted by some that carbonic acid is not in itself poisonous, but that animals immersed in it die simply from want of oxygen; this is not correct, for carbonic acid exerts a direct poisonous action when respired. Pure air consists of about one part of oxgen and four parts of nitrogen, but if the latter gas be replaced by carbonic acid, an animal placed in such a gaseous mixture will instantly expire, proving that carbonic acid has not the harmless properties of nitrogen.

It has been proved that as little as five per cent of carbonic acid in air will affect birds in two minutes and kill them in half an hour, and it has also been proved that a very small excess of carbonic acid will bring on an apoplectic fit in persons subject to this disease. Even aerated waters have been known to cause giddiness and intoxication when drunk too freely, and the rapid intoxicating effects of sparkling wines are probably due to some extent to this constituent. The instinctive effort to withdraw the face from the surface of a fermenting wort has been experienced by every brewer, and is due to the irritation of the throat produced by the gas, and which causes the glottis to rapidly close itself. It is a very common and wise precaution to lower a burning candle into a well or vat before allowing a workman to descend, but even this is not a sufficient test of security, for a candle will burn in air which contains ten or even twelve per cent of carbonic acid—a quantity more than sufficient to cause immediate death to some persons.

The disastrous accidents which have occurred—we record one in our present issue—ought to lead principals of breweries to take every precaution to protect the lives of their workpeople. The candle test is a most useful one, but too much reliance should not be placed on it; no man should be allowed to enter a fermenting vat without help being at hand, and care should be taken that the aperture through which the vat is entered is large enough to allow of a speedy exit in case of accident. In clearing a vat of carbonic acid, advantage should be taken of the heaviness of this gas; by having an opening in the bottom of the vat the gas will rapidly pour out like a liquid, and in this way the largest vat may be quickly and completely cleared of all carbonic acid. —*Brewers' Guardian.*

Theory of Lighting.

Lord Rayleigh, F.R.S., in a paper read in Section A, British Association meeting, York, says:

It is known that a large part of the radiation from terrestrial sources is non-luminous. Even in the case of the electric arc the obscure radiation amounts, according to Tyndall, to eight-ninths of the whole, and of the remainder probably no inconsiderable part is to be found in the extreme red rays of feeble luminosity. For practical purposes this obscure radiation is useless, and the question forces itself upon us, "Whether or not there is any necessity, absolutely inherent in the case, for so large a proportion of waste." The following arrangement, not, of course, proposed as practical, seems to prove that the question should be answered in the negative.

Conceive a small spherical body of infusible material, to which energy can be communicated by electricity or otherwise, to be surrounded by a concentric reflecting spherical shell. Under these circumstances no energy can escape; but if a small hole be pierced in the shell, radiation will pass through it. In view of the suppositions which we have made, the emergent beam will be of small angle and may be completely dealt with at a moderate distance by a prism and lens. Let us suppose, then, that a spectrum of the hole is formed and received upon a reflecting plate so held at the focus as to return the rays upon the lens and prism. These rays will re-enter the hole and impinge upon the radiating body, which is thus again as completely isolated as if the shell were unperforated. We have now only to suppose a portion of the focal plate to be cut away in order to have an apparatus from which only one *kind* of radiation can escape. Whatever energy is communicated to the internal body must ultimately undergo transformation into radiation of the selected kind.

REMEDY FOR INTERMITTENT FEVERS.—Dr. Brunetl recommends, as an efficacious remedy in intermittent fevers, a preparation composed of twelve grammes of the chloride of sodium and one gramme of ferric carbonate. This is to be divided into six doses, to be taken in twenty-four hours. To prevent the recurrence of the malady, one dose a day is to be taken for the following week.

MISCELLANEOUS INVENTIONS.

The "Law" system—that is, the *two-wire* system, one of which is used exclusively by all the subscribers of an exchange to talk to the central office to give orders to the operator in attendance, without any signaling forward and backward by bells and annunciators—seems to be the approved method, and will doubtless supersede all other plans in due course of time. Its general adoption has been retarded in a great measure for the reason that no good method has been discovered before of placing the system on circuit wires, or, more plainly speaking, two or more stations on the same wire. Telephonic companies have hesitated to incur the expense of giving each of their patrons a wire for their individual use, preferring to retain the magneto method, with all its faults, by which this could be done. With Mr. Crowley's improvement the Law system has no objectionable feature whatever. All the companies can adopt it now and place as many stations as is desired on the same wire. This improvement has been practically demonstrated on two exchanges, Augusta, Ga., and Richmond, Va., where the subscribers on the same circuit signal and talk with each other without the aid of the central office operator, and at the same time they have the superior method of communicating with the central office at their command, with a view of conversing with other subscribers not on their circuit. This improvement will be an immense advantage in cases where parties have telephones at their offices and manufactories or offices and residences, by being at all times in easy readiness to call their manufactories or families, and *vice versa*, by simply tapping on the little key placed at each station. It requires no awkward turning of a magneto crank and at the same time pushing in a button with certain pauses, giving an *uncertain* ring on the distant bell and annunciator, placing the switch to the right and left, thereby creating delay and confusion, and nine times in ten awakening the "wrong passenger." The day is fast approaching, if it has not already arrived, when the question of *room* to place the increasing number of wires on the street poles and housetops will seriously agitate the telephonic companies. These poles and wires are already unsightly, and in some cities the authorities have objected to any further encroachments. The wires will eventually be placed underground beyond a doubt. An application of machinery or battery, or both, that will work with satisfaction and calculated to reduce the number of these wires, even in a very small percentage, must prove a desideratum with telephonic companies, and will avail themselves of such discoveries without hesitation. The Western Union Telegraph Company appreciated this point by paying an immense sum for the duplex and quadruplex apparatus. Mr. Crowley's invention appears to have this essential point in view, for with judicious location of subscribers on the part of the Law exchange manager he certainly can put two subscribers on a wire where he has only one now without detriment to either, thus practically "duplexing" the wire. Managers of "magneto" exchanges will now be enabled to discard their old-time method and adopt the new at a minimum cost and inconvenience, and give their patrons an equivalent for their money.

An improved bobbin has been patented by Mr. Albert H. Carroll, of Baltimore, Md. This invention relates to an improvement in that class of filling bobbins for the shuttles of looms in which the head or cone is provided at its end with a transverse slot to receive the lug of the winding spindle when the bobbin is being filled, and in which a notch or cut is made in the sides of this head or cone to receive the spring of the shuttle, which holds the bobbin in place in said shuttle.

Mr. Gregory Lukins, of Sweetwater, Ill., has patented a composition of matter for preserving wood, consisting of carbonate of potash one part, saltpeter four parts, and common salt two hundred parts.

Mr. William Beeson, of Dillon City, Montana Territory, has patented a new flying ship or machine for soaring in the air by aid of the wind and gravitation. The invention consists in a boat or so-called "basket" or "car" provided with two uprights gradually separating from each other toward the top, and provided with transverse bars, to which sails are attached and stretched from one upright to the other, the ends of these transverse bars being connected by ropes wound around a drum provided with a crank, by means of which the inclination of the sails can be varied at will.

An improvement in the manufacture of sugar has been patented by Mr. Emil Fleischer, of Dresden, Germany. This invention relates to the manufacture of sugar from saccharine solutions, such as sirup, treacle, etc., by means of a bibasic saccharate of strontia, and in the apparatus in which the strontia sugar that has been formed is separated from the non-saccharine liquid. This invention consists in producing a bibasic saccharate of strontia, which is separated from the non-saccharine liquid and placed into cold chambers, in which the strontia crystallizes and is separated from the sugar.

Mr. George W. Ellis, of Philadelphia, Pa., has patented an improved truss for reducing hernia, in which the pad is attached to the spring by means of a metal bar having a spherical head that is confined between two clamping plates or jaws, forming a permanent and rigid attachment of the spring.

An improved swing which can be conveniently suspended from the walls of a room, and which can be operated by the person occupying the seat of the swing, or by a person in any other part of the room, has been patented by Mr. Joseph A. Tunnington, of Elyria, Ohio.

An improved car wheel mould has been patented by Mr. John Forbes, of Harrisburg, Pa. This invention relates to certain improvements in car wheel moulds of that form in which the metal is poured through a central hole in the core and rises into the wheel space from the bottom; and it consists in forming a hollow core with an annular re-enforcing metal stiffening in it, perforated to permit the passage of air and gas through it, and combining this with the drag-sand, which is formed with a circular recess to receive the lower end of the core, and radiating channels that connect the hole in the core with the wheel space.

The flat link chains in common use are made of links riveted together, the strength of the chain being determined by the quality and size of the rivets and their resistance to the shearing strain or pull of the links, and when a link breaks one or two links have to be cut out and a new link put in, and new rivets also, which latter must be upset. Hence the operation of repairing a flat link chain of ordinary construction is slow and expensive. Mr. James T. Brough, of Jacksonville, Fla., has patented an improvement intended to facilitate the repairing and lengthening and shortening of flat link chains. The improvement consists of a flat link chain having the thick or double link made with both faces recessed and socketed at each end, the socket being undercut, and in forming each single link with a flat-headed stud projecting at right angles from one face at each end. The chain is made by coupling the double and single links together by means of the engagement of the studs on the latter in the undercut sockets of the former.

An improved apparatus for the water packing of snow-roads has been patented by Mr. Henry I. Grennell, of Medford, Wis. The object of this invention is to water pack the snow in the runner-tracks of snow-roads, and thus form a solid path way for sleighs. The invention consists of a sleigh carrying a water tank and heater and suitable conducting and delivering pipes, whereby the water may be heated and the hot water delivered into the runner-track of snow-roads to pack and solidify the same.

Mr. William T. Hall, of Fayetteville, Ind., has patented an improved stock car. The invention consists in dividing the interior of the car into compartments or stalls by a series of hinged posts connected by hinged end partitions and separable side partitions.

There are various methods of pivoting the natural roots of human teeth, but they fail or are defective in the matters of strength and firmness and in preventing the decay of the root. Dr. Henry W. F. Büttner, of New York city, has patented an improvement in artificial teeth, which consists in turning down the upper end of the tooth root, so as to form a circular shoulder thereon, the irregular upper surface of the tooth being cut off in a horizontal plane to accurately fit the metallic cap which carries the artificial crown. A cap fits upon the root, and it has an artificial crown attached to it.

Mr. Isaac T. Tichenor, of Auburn, Ala., has patented an improved material for making bags, which is impervious to atmospheric moisture, is not destroyed easily by the corrosive action of the contents of the bag, and is rendered strong and durable. The invention consists in a coarse cloth, such as a burlap, which is covered on one or both sides with a mixture of clay and tar.

Mr. John J. Tierney, of New York city, has patented an improved door securer, consisting in the combination with a screw, for securing a door, of a post socket having on its forward end the right angled plate fitting into a rabbet of door post and secured by screws, so that a burglar cannot remove the socket, even after he has withdrawn the bolt.

Mr. John B. Bennett, of San Luis Obispo, Cal., has patented an acoustic or mechanical telephone in which certain improvements render the instrument more efficient in giving a louder and clearer sound than has hitherto been obtained. It is of such construction that it can be placed in almost any place or position required.

THE GASTROSCOPE.—AN ELECTRIC LIGHT FOR THE HUMAN STOMACH.

The application of electricity in ways the most varied, and, perhaps, we might add, unexpected, has, within the last few years, developed with almost bewildering rapidity. As in so many other things, it has its applications also in medicine; perhaps one of the most novel and ingenious of these, as well as the least generally known, is the employment of the electric light to illuminate various parts of the body which are only obscurely visible, if they can be seen at all, under ordinary circumstances. There have been many instruments, says Mr. H. Wilson in the *English Mechanic*, designed to facilitate in this way the diagnosis of the less accessible cavities of the human frame. The ordinary instruments are constructed to reflect the light either of day or of some artificial source upon the part to be examined. The bright tablespoon which a medical man will often use to help him to see a sore throat more clearly by reflecting additional light upon it, is of course a primitive form of such instrument. In some of the most recently perfected of these appliances a small piece of platinum joining the electrodes from a source of electricity, is placed in the focus of a small mirror. By allowing a carefully regulated electric current to circulate through the wires the platinum is, of course, raised to a white heat and emits a brilliant light. This is reflected upon the part to be diagnosed, which is thus made clearly visible to the operator. Instruments for viewing the interior of the bladder, the œsophagus, or the stomach (for this unruly and mysterious source of trouble is no longer to escape the searching gaze of science), are necessarily more complicated than those for diagnosing, for instance, the mouth or the ear.

We select the gastroscope for viewing the interior of the stomach, as the most ingenious and remarkable of all these instruments which have recently been brought to great perfection in Vienna, and also as showing to what a point of delicacy the execution of scientific instruments has been carried in our day. We should add that the gastroscope is not a mere model or plaything, but has been in actual use. A figure of the complete instrument is shown in the two blocks, Figs. 1 and 2, and reference to it and to the smaller cuts will enable us to explain the principal features, which will, we think, interest all lovers of ingenious mechanical appliances.

The gastroscope consists mainly of a rigid horizontal tube, Fig. 1, *a*, terminating in one direction in the eyepiece, L, and in the other prolonged into a partially flexible tube, which can be passed down the œsophagus until its end reaches the stomach. This flexible metal tube, Fig. 2, is formed of 60 annular pieces, united by lateral joints, and thus forming a completely closed tube, whether it be disposed in a straight line or in a curve, without any chinks or openings, in which, did they exist, the folds of the mucous membrane might easily be caught and lacerated. This close-fitting arrangement is effected by making the inside of the upper end of each annular piece taper outward, and the outside of its lower end taper inward to an equal extent, so that one piece fits into another. As this tapering is only effected out of the thickness of the metal, this gullet-pipe constitutes a tube of uniform diameter both within and without. Moreover, the edge of each of these annular joints is filed away on opposite sides; on one side to a considerable extent, so as to enable it to be bent into a spiral, but on the opposite side only enough to allow it to be opened out till it forms a straight line. A glance at Fig. 2 will best supplement this explanation.

The jointed flexible tube terminates in a sort of tiny lantern, *z*, which consists of an inner and an outer glass tube-head. Inside the inner glass is seen the little loop of platinum wire, Pt, the ends of which are of course joined to wires which run up the interior of the tube and can be connected at pleasure with the electrodes of a battery, by means of the screws, *d* and *n*, Fig. 1, and thus cause the incandescence of the platinum, which furnishes the illumination. From this, light radiates freely on all sides and illuminates the interior of the stomach. A portion of the rays which fall upon the side opposite to the little window, O, Fig. 2, situate immediately above the lantern, *z*, are of course reflected back into it, where by means of the prism, Pr, Fig 3, they are reflected upward in the vertical direction of the tube. Passing through the series of lenses, Li, they are parallelized, and arriving at the bend, Lt, Fig. 1, are deflected by refraction to a horizontal direction by the coupled prisms about to be described, and seen in Figs. 4 and 6, whence, reaching the eyepiece at L, they convey to the observer's eye an image of a portion of that side of the stomach which may be opposite the window, O.

In order to deflect the rays of light from the vertical direction of the tube, *s*, to the horizontal one of the tube shown in Fig. 1, which terminates in the eyepiece at L, prisms are employed in the bend at Lt. Fig. 4 shows the arrangement of these prisms, which are coupled immovably upon the curved piece of metal, *by*, and are attached at their apices on very narrow metal supports, *st*, *st*, to the curved plate, *pl*, the exterior of which is seen in the under side of the bend at Lt, Fig. 1. (Fig. 5 represents the guide-tube without this plate.) The most ingenious feature of this arrangement is that it allows the gullet-tube to move freely backward and forward through the curved outer tube or guide, Fig. 5, and yet at the same time maintains the prism in a constant position. This is effected thus: The guide-tube, Fig. 5, has a small oblong aperture, Oe, on the under side, which is of just sufficient size to allow the insertion of the prisms one after another. The aperture itself is prolonged into a slit for some little distance in the direction of the lower end of the tube. A corresponding slit in the tube, *s*, Fig. 1, slides along the prism supports, which thus offer no obstacle to the motion of the gullet tube, which in this manner is movable within the outer tube, while the latter and its inclosed prisms retain a constant position. This arrangement will be better understood by a reference to the sectional drawing of the two tubes and prism plate, Fig. 6.

To obviate the inconveniences which might arise from any elevation of temperature in the stomach, the space between the two glasses of the lantern is kept filled with water, and communicates with two diminutive caoutchouc pipes, *rr*, conveyed down the main tube, as seen in the sectional drawing, Fig. 7, and terminating in the bent nozzles, *e e*, Fig. 1. To these further India-rubber tubes are adapted, one to supply, and the other to lead off the water which is thus kept in perpetual circulation, and the temperature of which has of course to be regulated so as to obviate any inconvenient degree of heat produced in the stomach.

The crowning piece of contrivance and delicate workmanship in the instrument is an elegant appliance, by which the extremity of the gullet-tube, with its little window, may be made to revolve. The operator has merely to turn the little milled wheel, Rl, Fig. 1, round which is stretched the silk cord, *fil*. The latter passes down the tube and round the tiny wheel, *kr*, shown in the section of the tube, Figs. 8 and 9. This tiny wheel, which, it will be observed, is toothed, plays into an indented ring round the interior of the lower rotatory portion of the tube, Fig. 9, which it can by this means cause to revolve whenever motion is imparted to itself by the agency of the silk cord which communicates with the milled wheel, Rl, placed conveniently near the eyepiece. This ingenious and delicate contrivance obviates the neces-

Fig. 1.

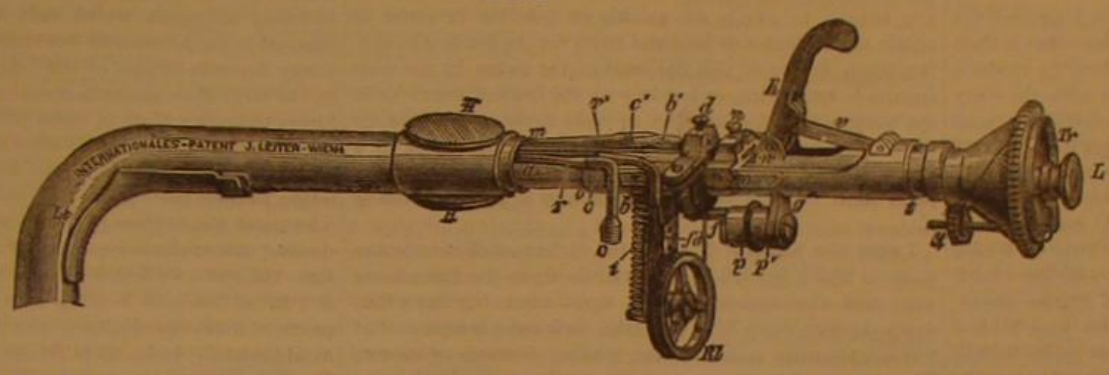


Fig. 3.

Fig. 2.

Fig. 4.

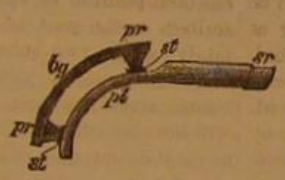


Fig. 5.

Fig. 6.

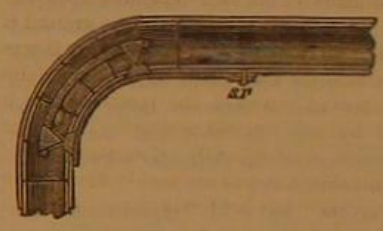


Fig. 7.

Fig. 8.

Fig. 9.

sity there would otherwise be of withdrawing, readjusting, and reinserting the instrument in order to observe different portions of the stomach, for the slightest turn of the wheel, R, causes a corresponding movement of the terminal of the gullet-tube with its window, and thus makes different parts of the interior circumference of the stomach successively visible to the eye of the diagnoser. Wherever a small supply of electricity is to be had, there the instrument may be used. A small portable apparatus for preserving a sufficient quantity of electricity has been designed by the maker, and now that the storage of electricity has become a recognized possibility, the ingenious instrument we have very briefly described may probably prove a welcome aid to the medical man in throwing a new light upon the stomach, that mysterious source of so many of "the thousand natural shocks that flesh is heir to."

Woolen Thread.

BY CHARLES VICKERMAN.

I have said that our worsted friends could spin our forty skeins wool into an eighty skeins worsted—a pure worsted thread is the smallest or highest state of tenuity into which wool can be got as a textile thread, and a pure woolen thread is the converse of this, it is wool in its thickest form or lowest state of tenuity as a textile thread. In worsted all the wool is available to go into the body of the thread, as the fibers are just laid end to end and parallel to each other. In the woolen thread, owing to its peculiar construction, part of the fiber is required to form that outside fringe, and the body or core of the woolen thread has not the fibers parallel. Thus the one stands at the North Pole and the other at the South Pole of the wool industry.

I wish it distinctly to be understood that I quarrel not with people as to the kind of yarn they prefer; that is their lookout, not mine. I aim only to place before the reader a scientific definition, and if he is not content with the forty skeins got out of the wool we have been considering, send part of the wool into Belgium, and he will get it spun to 55 skeins. You have a perfect right to have your own way, and to be pleased with seeing and having a nice yarn, small spun, as well as anybody else—some people have quite a passion for a deal of yard stick, give them plenty of length for their money, and they are satisfied. Got your yarn back from Belgium, have you? Yes, and *spun to fifty-six skeins.* Like it? Yes, it's beautiful, beats the English yarn hollow—it's smart, clear, and glossy, it's quite a coat on its back—the English yarn looks rough and hairy when laid alongside that I am quite ashamed of it; the Belgian yarn is immensely superior; it's a most beautiful yarn, and besides and better than all, *I have sixteen skeins more length* (there goes the yard stick again). Beautiful yarn, is it? Yes, *very beautiful indeed!* Allow me to remind you again that beauty is in the eye of the beholder, and it depends upon what the beholder understands by what he sees, and that again depends upon the correctness of the beholder's knowledge and perception of what is beautiful.

You have reckoned up the "haves" in respect to this Belgian yarn—you have more skeins—you have more smartness—you have more *clearness*—you have more *beauty*. Have you reckoned up and deducted the "*have nots?*" You have sixteen skeins more length, but on one side of the "have nots" you have sixteen parts lost of the *wooleny* character of the yarn. W-e-ll, but I don't see it in that way. I don't suppose you do; but whatever you want more than about half the worsted length, can only be had by sacrificing a corresponding proportion of the *wooleny* character of the yarn. You must not expect that you can be allowed to run off with all the sixteen skeins extra length and retain the *same wooleny* character in the yarn. You can have either one or the other, but you must not think to run off with both. You have got sixteen parts more length, then you have only twenty-four parts left of the wooleny character—fifty-six skeins of the length added to the twenty-four of the wooleny character make up the eighty skeins of the worsted spinner, at which point every vestige of wooleny character is gone. Try the carpet worsted spinner if you like, and get sixty-six skeins out of your wool, and then you will have only fourteen parts of wooleny character left to make up the eighty, where the game ends.

By carding as the Belgians do *you lay* the fiber of the wool *more toward the worsted form*, and that is the reason why you can spin it further, but it is at the expense of the *wooleny character*, and the yarn is all the less worth when it is spun. The Belgian system of carding is simply combing on a carding machine, as far as that is practicable; it is lashing out the fiber and laying it as much toward the parallel as possible. The Belgian carder does not use his stripper, nor does he use his fancy as we do—the strippers don't touch the workers, nor does the fancy work into the cylinder card. So that with cards set in this manner nothing but clean all-wool work could find its way through the machine, and that only in a lashing, combing manner. You can give what name you like to such a mode of working, but it certainly is not carding for woolen in its truest and best sense.

Oh! but the Belgian card is a "*specialty*," chimes in some one, and calculated only to work pure wool. To all such specialty talk I beg to reply that the Belgian card will do almost any kind of work, and that is the best finishing card in the world; but that as a breaker card it is neither fit to work in Belgium nor anywhere else. Its true position is that of a finishing card, in which position, when properly worked with a proper fancy, it will turn off work in mixtures, mungo and wool, as well as pure wool, in such a style as no other card can. But I must not go into the subject of carding, as it is a subject of wide range, and has ample material in it for discussion.

There is one part of my subject, and that is the use, or uses, to which woolen yarn can be applied; and as a preliminary to that we must fix in our own minds which way to twine it, whether "*crossband*" or "*openband*," and that again will depend upon the class of work we intend to use it for, whether for plain goods or for fancy goods. In the production of fancy cloths, whether in self color or in various colors, design or pattern has to be aimed at, and this involves sharpness of outline; and in order to *obtain* and *retain* this sharpness of outline, not only must the warp and weft thread cross each other at right angles, but the folds of the twine of the warp and weft thread must cross each other at right angles also, to enable the threads to retain their distinctness of individuality in the fulling *or milling and the finishing*. In using warp and weft spun the same way of twine, the folds of twine *do* cross each other at right angles in the cloth, thereby removing, as far as possible to remove, the liability of the fibers, and even of the threads themselves, to mingle bodily in the milling.

If our object in using our woolen yarn is to make a plain cloth, such as a doeskin or a superfine black broad, where it is requisite to hide the make of the cloth, then in order to obtain this result the weft requires to be twined the opposite way to the twine of the warp, in order to afford the greatest facility for the fibers mingling quickly, and felting and forming one homogeneous mass, hiding every vestige of the "make" or framework of the fabric. In the fancy cloth you require to preserve as much as possible the individuality of the threads for the sake of the pattern; in the plain cloth you require to lose it as quickly as possible in order to obtain the closeness of face and cover for the finisher to operate upon, and to do this the folds of the twine in the weft require to meet with, or fall in with the folds of the twine in the warp, *and not cross them at right angles* as in the fancy cloth. By using opposite twine for warp and weft in a fancy cloth you get closeness and evenness of face as in the plain cloth, but you sacrifice distinctness of pattern in doing it.

I need not attempt to name the variety of cloths for the make of which woolen yarn is useful—from the flannels we wear, and the blankets we rest upon after our day's toil, down through every kind of cloths, their name is legion—but will ask attention to one of the leading features of its use. The very peculiar structure of the woolen thread eminently fits it for the make of all kinds of cloth that require to be felted or "*milled.*" The worsted thread we have been considering is from identically the same wool, but its formation precludes it being made into goods where much felting is required. If you attempt to mill a fabric made from worsted to any considerable extent the material will gather up into beady lumps which we call "*nigger heads;*" the structure of the worsted thread is not fitted for felting or milling, whereas the woolen thread from its very structure is, in the highest degree, fitted and adapted for all kinds of fabrics where felting is requisite. As an extreme instance of its power of usefulness in this direction I may mention that the Greenland whale fishermen's stockings are knitted wide enough and long enough to admit of being drawn over and to cover the entire men's bodies, and are then taken and felted or milled down to the proper size in order to give them the thickness and warmth necessary to withstand the rigor of that northern region. The Scotch Highlander's cap, or bonnet as he calls it, is often knitted the size of a cartman's hay net, and then felted down to the size of the human head, hence their extraordinary wear. Another instance of the power of combination and strength through felting is the mysterious Gordian knot, of which we read in history, which promised the empire of the world to him who could untie it, and Alexander the Great is said to have cut it into two with his sword because he failed to untie it. This celebrated legend, if not altogether fabulous, is supposed to have had its foundation in the illustrious Gordius having cunningly felted his compound knot before hanging it in the temple.

Those tiny fibers, so insignificant and weak in themselves when tested separately, yet in combination and felted they are capable of being formed into a fabric that will resist tearing to an enormous degree, and are capable of resisting untold tons of pressure—in fact, no amount of pressure hitherto known, not even the hydraulic, can compel a wetted woolen fabric to yield up its water, yet the same fabric when relieved of its pressure and taken and hung up by one end, will quietly and of its own accord, drop by drop, yield up the water which it refused to yield to all the force that could be brought against it.

The cause or means by which, till lately, this very extraordinary and very mysterious process of felting is accomplished is the presence of these minute and curiously laminated scales that I have spoken of as being in immense numbers upon the stem of each hair or fiber of wool; and as in carding and spinning we had to use oil to prevent these scales locking into each other, so in the fulling or milling we have to pursue an opposite course, and apply soap to overcome any remains of grease that may have been left in the fabric, as no felting can be commenced until all the grease has been overcome. By the application of liquid soap we can clean out and open the mouths of these tiny scales; they open their mouths to soap like the flowers open to the sun, and hook into each whenever the fibers touch. Till recent years the greatest philosopher could not explain to us the principle on which the felting effect was produced in wool—there was the practical fact for thousands of years unexplained. To the presence of these scaly excrescences upon the hair or fiber of wool, and to the peculiar structure of the woolen thread, we owe those very remarkable transformations of textile fabrics from the loose, open, unserviceable, friable textures into those compact, unfriable, wear-resisting fabrics, which when fully milled and of fine quality result in those magnificent cloths made in the west of England.

The Magnesia Industry.

If we cause a solution of magnesium chloride to be absorbed by dry slaked lime, the magnesia set at liberty plays the part of a cement, and the matter may be moulded into small porous fragments. If one of these fragments is suspended in a solution of magnesium chloride, after some days the lime is entirely substituted by hydrate of magnesia. The fragment has been the seat of a double diffusion; the magnesium chloride has diffused itself from without to within, and is changed in the fragment into calcium chloride, which in turn becomes diffused from within to without. These two diffusions are simultaneous, and come to an end when all the lime has been substituted by magnesia. Here, then, is a means of reducing into a small volume a precipitate which would have occupied the entire bulk of the solution, if the fragment of lime had been stirred up in it at first. The same phenomena are produced if a great number of such fragments are heaped up in a suitable vessel, where a solution of magnesia is made to circulate slowly from the top to the bottom. In five or six days the conversion is complete; the solution may be replaced by pure water, and the magnesia washed completely. On stirring up it becomes a white pulp, which, if dried in the air, gives a very friable mass. It is hydrated magnesia which may remain for a long time exposed to the air without becoming notably carbonated. Its purity depends on that of the lime employed. In working on the large scale the author uses a paste of lime, which he forces through a plate of metal pierced with small holes, so as to eliminate stones and unburnt pieces. If these "worms" fell upon the ground, or into water, they would at once return to their pasty state. He therefore receives them in a solution of magnesium chloride, where they become at once covered with a slender coating of magnesia, which consolidates them so well that they may be heaped up to the height of 1·50 meters, still leaving between them the interstices needful for the circulation of the liquid. The paste of lime should contain from 34 to 36 per cent of anhydrous lime. The solution of magnesian salt should contain from 25 grammes to 40 grammes of anhydrous magnesia per liter. The laws of diffusion laid down by Graham are here at fault. The acceleration of the phenomena, due to an increase of strength, is balanced by the resistance opposed by a more consistent deposit of magnesia. The presence of sodium chloride, always abundant in the water of salt marshes, is indifferent. Soluble sulphate must be removed by adding the water from a former operation, rich in calcium chloride, and allowing the calcium sulphate to settle, after which the clear liquor is run off for treatment.

AGRICULTURAL INVENTIONS.

Mr. George H. Fowler, of Taughannock Falls, N. Y., has patented a horse hay-fork constructed with grappling bars hinged to each other by a cross head clevis. Trip levers are provided to receive the trip rope, whereby the loaded tines will be locked in place automatically, and unlocked by operating the trip levers.

Mr. Abner D. Dailey, of Riley, Ind., has patented a self-acting rest or support for the tongue of a harvester or similar machine, whereby the necks of the animals drawing the machine shall be relieved of the increased weight which is thrown upon the tongue when the machine comes to a stand.

An improved fertilizer distributer has been patented by Mr. John C. McCaskill, of Shoe Heel, N. C. This invention relates to improvements in that class of fertilizer distributers in which the feed hopper carrying the fertilizer and provided with a cut-off is secured to a plow beam, and it consists of a reciprocating cut-off having both its edges sharpened, whereby less power is required to operate the cut-off, and the lumps are divided by the cut-off.

The Destroyer of the Spruce Trees.

Maine's lumbermen—and, therefore, a large part of the rest of her citizens—are much disturbed by the destructive insects which are killing the spruce trees not only in that State, but in the adjacent British Provinces. The pine has lost its pre-eminence, and the spruce was getting in a position to be the representative tree, but the *Urocerus albicornus*, if the thing has been correctly identified, the Augusta *Journal* says, is killing off the spruce faster than the lumbermen could have done it, and greatly to their detriment. The white-horned *Urocerus*, for that is what his name means, is about an inch long and with wings which spread to two inches. They are as likely to destroy the pines into which they bore as the spruces, so far as the entomologists know. These insects are very prolific, and not at all uncommon. In England it has been often noticed and recorded, but there it was injurious only to ornamental trees, not to those on which so much depends in a business way and in whose preservation so many people are interested as the spruce forests of the Northeast. The prospect seems to be that things will go from bad to worse. Unless some smaller insect comes to the front and destroys the eggs of the *Urocerus*, it is hard to see what is going to save our spruce trees.

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.

$30,000 cash will be given as a bonus to secure location of satisfactory manufacturing establishment in growing Western town, near good coal and having competing railroads. Address, with references, Western Town, Box 773, New York, stating character of business and present capital.

Mechanics' Watch.$10. Circul's free. Birch,38 Dey St..N.Y.

Turkey Emery, Star Glue, Pumice, Walrus Leather, Polishers' Supplies. Greene, Tweed & Co., 118 Chambers St., N. Y.

Patent for sale.—G. Neu, 171 W. Liberty St., Cin., O.

Davis' Invalid Bed, described in another column, with husk mattress, hair or cotton top, $35. Rights for sale. Geo. B. Davis, Richmond, Va.

Machinist and Fine Tool Maker wanted. One that has had experience on watch tools and fine model work. Steady employment and pay every week. Wm. Essick & Co., Reading, Pa.

Second-hand Upright Engine, in excellent order, for sale. 6 to 8 H.P. Trump Bros.Mach.Co.,Wilmington, Del.

Rolled Nickel Anodes, Grain Nickel, Nickel Salts, Platers' Supplies. Greene, Tweed & Co., New York.

Constant Current Electric Generator. Price, $3. Constant Current Cure Company, 207 Main St., Buffalo, N. Y. Send for circular. See advertisement, p. 253.

For Sale.—A complete set of Patterns, Flasks, and Core Arbors, for making Cast Iron Flanged Pipe, Elbows, Tees, and Greenhouse Fittings. Will be sold low to clean out a branch of a business. Address C. Box 1238, New York.

A pair of 15 x 24 Engines, good as new, for sale cheap, as they must be removed. J. C. Todd, 10 Barclay St., N.Y.

Superintendent wanted.—A man competent to superintend a works employing about 300 hands in building machinery and tools, and in manufacturing goods for a regular trade. None but a first-class man in all respects need apply. Address B, Box 2333, New York.

Ajax Metals for Locomotive Boxes, Journal Bearings, etc. Sold in ingots or castings. See adv., p. 256.

New Comb'd Milling and Gear Cutting Machines, large range. C. A. Condè & Co., Makers, Philadelphia, Pa.

A valuable article on the Treatment of Acute Rheumatism, by Alfred Stillé, M.D., will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 299. Anything from the pen of this eminent and experienced physician is interesting and instructive.

Foot Lathes, Fret Saws,6c. 90 pp. E.Brown,Lowell,Mass.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Alden Crushers. Westinghouse Mach. Co., Pittsb'g, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Cope & Maxwell M'f'g Co.'s Pump adv., page 254.

Punching Presses & Shears for Metal-workers, Power Drill Presses, $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co.,115 S.Liberty St.,N.Y.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. 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.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro. 234 Broadway, New York.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Peck's Patent Drop Press. See adv., page 269.

National Steel Tube Cleaner for boiler tubes. Adjustable,durable. Chalmers-Spence Co.,10 Cortlandt St.,N.Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

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

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 238.

The Sweetland Chuck. See illus. adv., p. 238.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor, Stiles & Co., Riegelsville, N.J.

Skinner's Chuck. Universal, and Eccentric. See p. 236.

For Machinists' Tools, see Whitcomb's adv., p. 238.

Draughtsman's Sensitive Paper.T.H.McCollin,Phila.,Pa.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

Common Sense Dry Kiln. Adapted to drying all of material where kiln, etc., drying houses are used. See p.254.

4 to 40 H. P. Steam Engines. See adv. p. 254.

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

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

Supplee Steam Engine. See adv. p. 270.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 255. Totten & Co., Pittsburg.

Saw Mill Machinery. Stearns Mfg. Co. See p. 269.

Paragon School Desk Extension Slides. See adv. p. 269.

Brass & Copper in sheets, wire & blanks. See ad. p. 269.

CONSTANT CURRENT CURE COMPANY,
207 Main St., Buffalo, N. Y.

SIRS: I am compelled to say that, contrary to my expectations, the Generator you sent me has performed a miraculous cure in my case. For seven weeks I had been almost distracted with neuralgia in my head. I had tried every prescription and remedy known, but without avail. When your package came by mail, I applied the electrodes with little hope for relief I confess; but *in twenty minutes the terrible pain that had been torturing me for seven weeks* DISAPPEARED ENTIRELY. I consider it only justice to acquaint you with these facts.
R. R. GREEN, 279 Leonard St., Brooklyn, E. D.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Ball's Variable Cut-off Engine. See adv., page 269.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Wren's Patent Grate Bar. See adv. page 269.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau street, New York.

The I. B. Davis Patent Feed Pump. See adv., p. 270.

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

Eagle Anvils, 10 cents per pound. Fully warranted.

Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser Mfg. Co., Waynesboro, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 269.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares, notions, and novelties in the above line, a specialty. See advertisement on page 270.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 268.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

New Economizer Portable Engine. See illus. adv. p. 270.

Fine Taps and Dies in Cases for Jewelers, Dentists, Amateurs. The Pratt & Whitney Co., Hartford, Conn.

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

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

Don't buy a Steam Pump until you have written Valley Machine Co., Easthampton, Mass.

Improved Skinner Portable Engines. Erie, Pa.

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) F. G. asks how to make a good cement for fastening sheets of pasteboard together. It must be waterproof. A. Good pitch and gutta percha (about equal parts) are fused together, and to nine parts of this are added three parts of boiled oil and one-fifth part of litharge; continue the heat with stirring until thorough union of the ingredients is effected. This is applied hot or cooled somewhat, and thinned with a small quantity of benzole or turpentine oil.

(2) A. B. B. asks for a simple and reliable method of testing coal oil. A. Place a small sample of the oil to be tested in a cup partially immersed in a vessel of water, and having placed the bulb of a good thermometer in the oil, heat the water gradually, and as the temperature of the oil rises apply the flame of a burning taper to its surface, and note on the thermometer the degree at which it inflames. This should not occur below 120° Fah. Many of the standard oils inflame only at temperatures 150° or higher.

English Patents Issued to Americans.

From September 13 to September 23, 1881, inclusive.

Albumen, manufacture of, W. H. Hillman, N. Y. city.
Cigar lighter, C. H. Vibbard *et al.*, Aurora, N. Y.
Corset, M. Cohn, New York city.
Crayon holder, C. W. Livermore, Providence, R. I.
Door knob, C. C. Harrington, Newton, Mass.
Dynamo-electric machine (2), T. A. Edison, Menlo Park, N. J.
Electric cable, P. B. Delany *et al.*, New York city.
Electric lamp, E. M. Fox, New York city.
Electric lamp, A. E. Brown, Cleveland, Ohio.
Electrical alarm apparatus, H. C. Boome, Jersey City N. J.
Fastening device for dash boards, C. F. Littlejohn *et al.*, New Haven, Conn.
Hair pin, Mary T. Foote, Boston, Mass.
Heel blank machine, J. W. Brooks, Boston, Mass.
Lamp burner, W. Painter, Baltimore, Md.
Life boat, G. B. Berrell, Pennsylvania.
Needle, R. Crowley, New York city.
Paving block, W. Hunt, New York city.
Reflector, W. Wheeler, Massachusetts.
Railway signaling apparatus (2), W. W. Gary, Boston, Mass.
Sawing machinery, F. Myers, New York city.
Sewing machine, F. G. Aitman *et al.*, Medina, Mo.
Show case, L. G. Blood, New York city.
Stitching buttons, Morley Sewing Machine Company, Holyoke, Mass.
Telegraph cable, J. B. Henck, Jr., Boston, Mass.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

September 27, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Acid, method of and apparatus for volatilizing cresylic, E. H. Carpenter 247,480
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Patent No. 61,543, issued January 29, 1867, relates to sharp-edged fertilizer feed slides, with attachments.

Patent No. 61,544, issued January 29, 1867, relates to axles, gear wheels and shields, etc. (subject to State rights of Henry Kuhlman to manufacture in Illinois and Missouri).

No. 61,545, issued January 29, 1867, relates to fulcrum placed between boot and spring hoe; also, vibrating seats, etc.

No. 90,556, issued May 25, 1869, relates to fertilizers and wheat sowers, with gauges opening each way from the center.

No. 104,854, issued June 28, 1870, relates to double acting reversible movement of fertilizer feeder.

No. 105,810, issued July 26, 1870, relates to slide block for adjusting the angle of spring hoes.

No. 105,811, issued July 26, 1870, relates to double rotary fertilizer sower.

No. 137,929, issued April 15, 1873. A peculiar arrangement of locking bars or hoe shifting.

No. 150,329, issued April 28, 1874, relates to improved slide blocks, with attachments.

No. 153,345, issued July 21, 1875, and reissued as No. 8,343 and No. 8,344.

No. 8,343 relates to throwing axle rail out of way of hoes.

No. 8,344 relates to portable hoe shifting rails.

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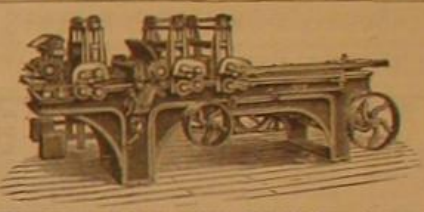

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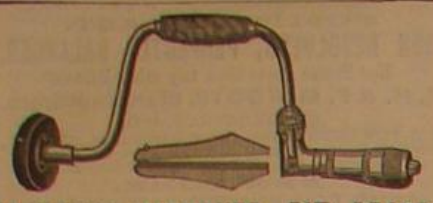

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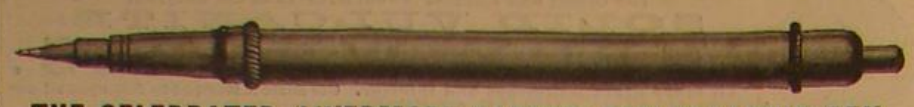

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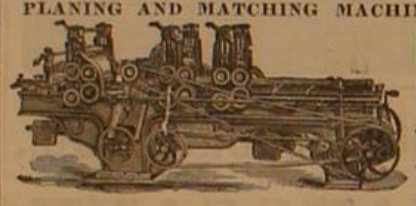

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THE OHIO RIVER.

The great drought of the past summer has had a much more depressing effect upon Western river commerce than ever before known, especially along the Ohio, upon which stream there has been an almost total suspension of steamboat traffic. During about two months of every year the river generally dwindles down to a mere semblance of its usual self, and the large steamers lie up, while a smaller class of light draught vessels continue the business. During the present season, however, the river has been lower than for nearly fifty years, and even the customary low-water packets have been obliged to cease running, and the mails and passengers are carried by a few tiny craft, drawing from 12 to 18 inches with cargo aboard. On a larger portion of the Upper Ohio no attempt to navigate the river is made.

At Cincinnati there is but *two feet* of water in the channel, and the small boys wade across at the levee, which in a good stage of the river is a bustling scene of activity, with scores of steamers moored at its edge, and the unscrupulous urchins on the Covington shore now toss stones through the deserted doors of the great floating docks on the opposite side. Above the city, dozens of large steamers are lying idle, among them big 1,500 and 2,000 ton New Orleans packets—a striking contrast to the brook-like stream they barely float in. The novel sight of a steamboat whistling for an ox team to "clear the track"—an actual occurrence recently—a steamer's crew in the yawl hunting for the deepest water, and other scenes along the river are depicted in our engraving, surrounding a view of the harbor at Cincinnati, sketched at the lowest period.

It is impossible for one at a distance to appreciate the effect of prolonged low water upon the vast region largely dependent on the Ohio River for all commercial activity. The river drains an area of more than two hundred thousand square miles, and from Pittsburg to its mouth is nearly a thousand miles in length. The numerous towns and cities on its banks, and to a large extent the interior country also, are supplied with coal and lumber from Pennsylvania; and to them low water means not merely diminished facilities for getting products to market, but a cutting off of fuel supplies and a general arrest of manufacturing industry, with a prospect of a fuel famine when winter sets in. To a large extent the Lower Mississippi region is supplied with coal floated down the Ohio in immense rafts of barges, and shares with the Ohio Valley the dearth of fuel incident to suspended navigation in the summer and fall.

It is not unusual for the water of the Ohio to become scanty during the summer, but a deficiency so great and so protracted as has been experienced this year, or anything like it, is happily rare.

For the first three hundred miles from Pittsburg the river is about 1,200 feet wide at high water, and at low water should be about 1,000 feet wide; with extreme low water this width is seriously infringed by sand bars. Below Cincinnati the width of the river increases until near its mouth it is 3,000 feet. The depth varies enormously, the range between high and low water being 60 feet or more. The usual range throughout the length of the river is 45 feet.

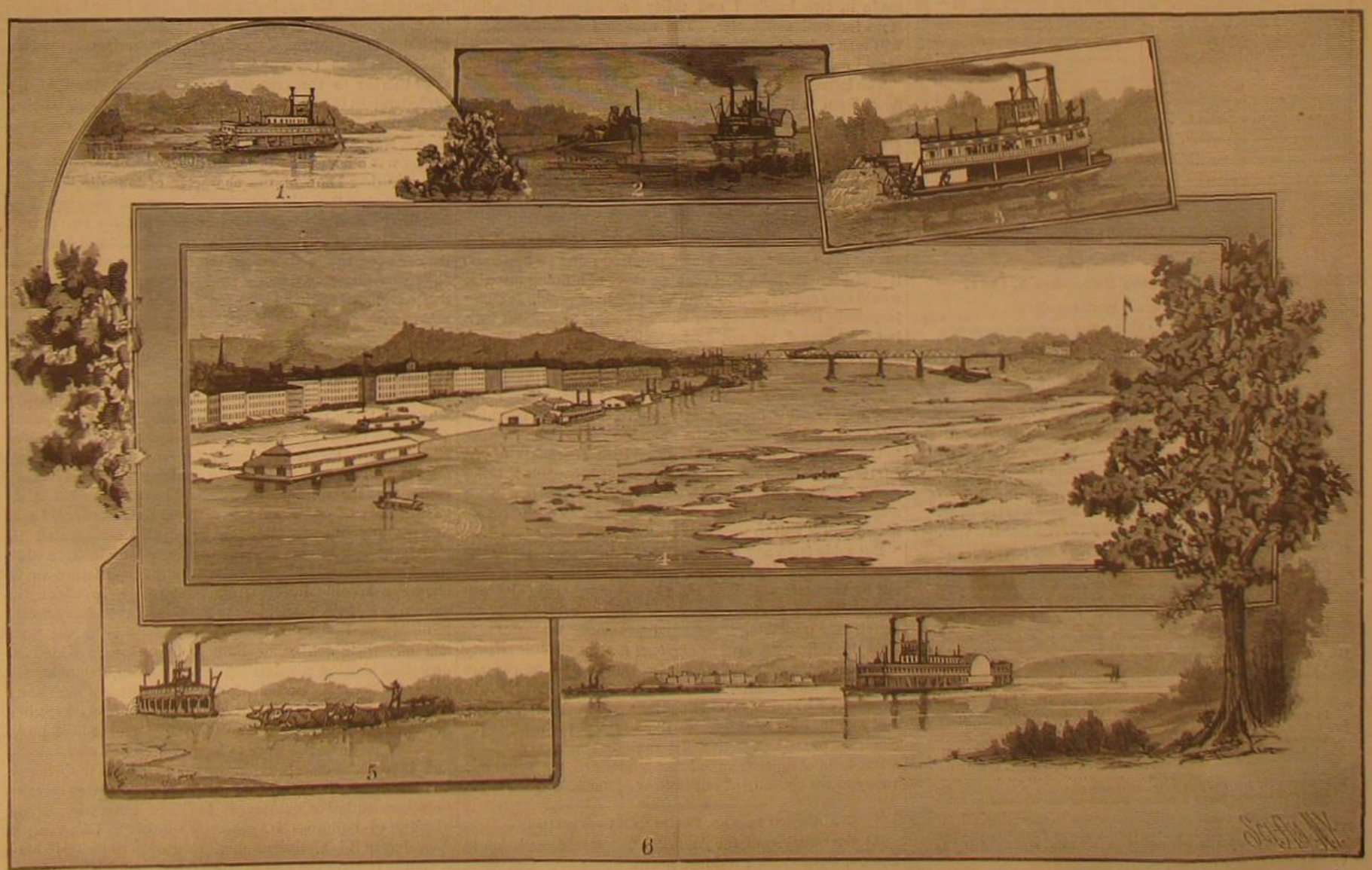
Our sketches are from the pencil of our artist contributor, Mr. H. L. Bridwell, and are drawn with much spirit. 1. A steamer hard aground. 2. Hunting the channel. The steamer's yawl is sent out ahead to pole the deepest places. 3. A low water boat at full speed, water 24 inches deep. 4. View at Cincinnati, looking up the river from the Suspension Bridge. 5. Steamer whistling for ox team to get out of the way. 6. Scene on the Ohio at the usual stage of the water.

The Poison of Human Saliva.

Recent observations by M. Gautier (communicated to the Paris Académie de Médecine) afford reason for believing that the poison of serpents differs from human saliva in the intensity of its effects rather than in essential nature, so that the fears with which a human bite is often regarded may not be wholly unreasonable. M. Gautier took some 20 grammes of human saliva, and, after lixiviating and purifying, obtained a substance which, injected in the form of solution under the skin of a bird, had remarkable toxical effects. Almost immediately the bird was seized with trembling. It staggered and fell to the ground in a state of coma and complete *stupor*, terminated by death in half an hour or an hour, according to the dose injected and the vigor of the animal. The phenomena resembled fully those produced by the bite of a venomous serpent. The poisonous matter of the saliva is thought to be an alkaloid similar to the cadaveric poisons called *ptomaines*, which MM. Brouardel and Boutmy have isolated. Like them, it produces Prussian blue when mixed with ferrocyanide of potassium. The facts stated throw some light on the question of virulent maladies. The present case, it is pointed out, is not that of a true virus; for at high temperatures a virus is destroyed, but when the salivary alkaloid is heated to more than 100° its poisonous property is not affected. M. Gautier studied comparatively the poison of the cobra (one of the most formidable of Indian serpents). This injected, in a dose of one milligramme in a quarter of a cubic centimeter of water, under the skin of a small bird, such as a chaffinch or a sparrow, kills it in five to twelve minutes. One observes torpor and coma, then a period of excitation, with convulsions and tetanic contraction. In connection with the subject, a correspondent of *La Nature* calls attention to a passage of Rabelais in which the poisonous nature of human saliva is recognized.

Postal Statistics.

The annual report of the Superintendent of the Free Delivery Division of the Post Office Department for the year ended June 30, shows that during the year there were delivered 262,425,668 mail letters, 59,968,559 mail postal cards, 76,733,208 local letters, 43,898,158 local postal cards, 2,126,209 registered letters, and 146,417,114 newspapers. There was collected at the 109 free delivery offices during the year 284,759,945 letters, 85,793,125 postal cards, and 54,075,476 newspapers. The cost of the service for the year amounted to $2,493,972.14, or 3 mills per piece.



1. Hard aground.—2. Hunting the channel.—3. The low-water boat.—4. The Ohio at Cincinnati, looking up the river from Suspension Bridge.—5. Steamer whistling for oxen to clear the channel. 6. Scenes on the Ohio at the usual stage of water.

LOW WATER SCENES ALONG THE OHIO RIVER.—DRAWN BY H. L. BRIDWELL.

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NEW YORK, SATURDAY, NOVEMBER 5, 1881.

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THE FONTAINE LOCOMOTIVE.

In the SCIENTIFIC AMERICAN of October 8 there was given a large engraving of No. 1 of the new type of locomotive engine designed by Mr. Eugene Fontaine, with a brief account of its peculiarities. In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT will be found a corresponding illustration of the Fontaine locomotive, No. 3, recently completed, with critical estimates of the value of the improvements introduced by the inventor. There is given also a sufficiently full statement of the behavior of these engines to enable the reader to form an idea of the reasonableness of the high expectation which the friends of the new plan of locomotive construction entertain with regard to the advantages it involves. The SUPPLEMENT paper referred to, it is proper to say here, is by Mr. John Ortton, Mechanical Superintendent of the Canada Southern Railway, under whose direction engine No. 1 has been running for several months. The high professional standing of Mr. Ortton gives weight to the judgment which he expresses—a judgment based on a critical study of the theory of the inventor as well as the practical behavior of the engine.

From the evidence thus furnished it seems to be abundantly established that the Fontaine locomotive marks a long stride forward in the direction of speed and economy in railway service. If it is not, as its friends confidently believe, the most important improvement made for many years in the construction of locomotive engines, it is still one that cannot fail to give a notable impetus to the advancement of railway engineering and to the social and commercial changes incident to increased facilities for rapid transit.

The distinctive mechanical features of the new engine have been sufficiently dwelt upon in the articles already mentioned. It is enough in this place to say that, by a bold and ingenious change in the manner of applying the power through auxiliary drivers, a large increase of speed is obtained with a given size of driving wheel without increasing the number of piston strokes or the amount of fuel consumed. Or, the speed of the train being constant, the improved method of applying the power and the more complete development of the working force of the steam enable the engine to haul a much heavier load than is possible with the engines in common use. Theoretically the advantage gained is nearly eighty per cent in speed or traction above the best performance of engines of the same size, built in the prevailing style—a practical gain of 30 per cent is deemed well within the bounds of demonstration.

The dimensions of engine No. 2, designed for freight service but not yet built, are given in the SUPPLEMENT.

The new engine (No. 3) has not yet been tested for speed. No. 1 has developed a speed approaching seventy miles an hour over long distances. In May last it drew a light special train from Amherstburg to St. Thomas, on the Canada Southern Road, a distance of one hundred and eleven miles, in ninety-eight minutes. The run from Amherstburg to Buffalo, two hundred and thirty-five miles, was made in two hundred and thirty-five minutes, including stops for coal and water. The expectation is that No. 3 will make ninety miles an hour, in which case it will be placed on the road between Jersey City and Philadelphia.

The influence upon commercial and social life certain to flow from an improvement like this—which greatly cheapens the cost of power for hauling freight and passengers—it is impossible to estimate. Social and commercial activity increases not in simple but in compound ratio with each step in the mastery of time and space, and in every instance hitherto the results of such improvements have surpassed expectation.

For ages men have envied the ability of birds to cleave the air at a speed approaching a hundred miles an hour, and it has been thought that nothing short of a flying machine would ever enable men to achieve a transit so rapid. It seems incredible that the problem should be solved without leaving the ground, yet not so incredible, nor half as improbable, as a speed of fifty miles an hour seemed to engineers fifty years ago.

There are few existing railways, it is true, on which it would be possible or prudent to drive a train at anything like the speed expected of the Fontaine locomotives, owing to the instability of the road-beds and the sharpness of the curves. But the improvement of established roads is being rapidly carried out, wherever the service requires it, and we may be sure that any degree of excellence which the future may demand will be promptly supplied.

But aside from any consideration of increased speed, the new locomotive (if experience shall confirm the promise held out by the performance of the engines now on trial), will materially increase the economy of railway service. There are already something like a hundred thousand miles of railroad in this country, employing not far from twenty thousand engines. All our great locomotive works are burdened with orders, some having contracts which will require two or three years of constant work to fill. Obviously an improvement which will add thirty per cent. to the efficiency of the locomotive, the running expense being the same, has the capacity of adding millions to the value and vastly to the capacity of our railway systems.

No Award in the Cattle Car Competition.

At the meeting of the American Humane Association in Boston, October 19, President Brown announced that there was no award by the judges of the $5,000 prize offered last year for an improved cattle car. Seven hundred designs and models had been submitted to the committee, but no one of them so complied with the conditions as to win the prize. Evidently the owners of good cattle car patents hold them at a higher figure that $5,000.

CASUALTIES IN BLASTING.

The introduction of the new blasting powders, especially those of which nitro glycerine is the basis, has given rise to many novel questions upon the responsibility for accidents. The workmen employed in engineering, quarrying, or mining operations, often disregard proper precautions simply because they do not know the nature and dangers of the explosives furnished for their use. This ignorance on the part of laborers, although natural and unavoidable, is the cause of many disasters. Gunpowder, formerly the only blasting agent used, has become quite well known to the common people. For more than a century the Fourth of July has been practically devoted to instructing the boys of the land that fire and gunpowder must absolutely be kept separate unless an explosion be desired. Thousands of casualties have re-enforced the lesson upon the minds of grown men in all the walks of life. What fact is better known than this, even among persons the least instructed? Quite otherwise as to the modern blasting powders. They have been so recently invented, are of so many kinds, and are in use under so many names, that no one should expect ordinary laborers to be fully acquainted with them all. Again, gunpowder can be fired only by an actual spark; if such a thing be possible as that it should be exploded by a blow, this could only occur under extraordinary circumstances, enabling the blow to heat the powder to the point of ignition. But, as all readers know, nitro-glycerine and its compounds, as well as some other agents somewhat used in blasting, may be exploded by concussion merely—the ordinary stroke of a hammer, the dropping of the can upon a floor or rock; and this concussion is believed to operate not at all by raising the temperature of the substance to the point where it will ignite, but, in some way not very well understood, by the change it introduces in the relation or position of the chemical constituents. The average laborer, though trained to recognize gunpowder and to guard it most carefully from every form of fire, does not equally know the blasting powders, either by sight or by their multitudinous names; nor does he realize that careless handling, an unlucky rub or stroke, may be to them what the spark is to the powder.

What once happened on a Boston railroad is a good illustration. Some one having work in hand involving blasting wrote to manufacturers of dualin for a quantity of that explosive, and to another manufacturer for a number of the exploders or detonators commonly used in firing it. It is a peculiarity of nitro-glycerine (also of gun cotton) that if a small quantity lying loose be touched with a match it will burn quietly; but if a blow be given to it an explosion will follow; and if the suddenness and violence of this blow be made as great as possible, which may conveniently be done by exploding some one of the fulminates in contact with the nitro-glycerine, the explosive power of the latter is raised to the maximum. Hence the use of exploders in connection with dualin. In the Boston accident the manufacturers of the dualin sent it, in cases plainly labeled, to the railroad depot to be carried to the customer. The manufacturer of the exploders sent those to the same depot; they also were labeled. Unfortunately both parcels reached the depot at the same time. Now this occurred ten or twelve years ago, when dualin was a novelty. The train hands saw the labels; but what did they know of the character of "dualin," the use of "exploders," or the peculiar danger of packing them together? And what did they do but put the two parcels side by side in the same freight car! The natural jolting of the car upon the journey fired the explosives and great mischief was done. Evidently such disasters are attributable not to carelessness in a strict sense, but to ignorance inseparable from the introduction of a novel and dangerous agent.

Recent books of court reports contain several cases illustrating the duties of those who furnish these powerful agents to untaught workmen. It is worth an employer's while to know that his obtaining leave from the public authorities to have a dangerous piece of blasting done does not diminish his responsibility for any disastrous consequences. There are rules of law limiting the right to keep explosives in store; and cities usually have somewhat stringent ordinances on the subject. When the Delaware, Lackawanna and Western Railroad Company constructed its tunnel through Bergen Hill it sought and obtained, in addition to the general authority given by the legislature in its charter, a specific license from Jersey City, in which the eastern end of the tunnel lay, to store the explosives needful in blasting. Under this twofold permission from the State and city their contractor built a magazine in which he deposited blasting powders. These exploded, damaging the adjoining houses. On behalf of the contractor it was shown that the magazine was built and the explosives kept in a most careful manner; no precaution was omitted. And he claimed that as he got leave to keep the explosives in stock, and kept them carefully, he was not liable for damages. The court said, in effect, that the keeping of nitro-glycerine or other explosive substances in large quantities in the vicinity of buildings is, generally speaking, unlawful; in New Jersey it is a misdemeanor. Getting permission to keep it simply relieves the person from this prohibition. It does not exempt him from damages if his dangerous goods explode. Whoever for his own profit stores these things in a city, must not only get leave, but also bear the entire risk.

Quite like this is a late New York decision relative to gunpowder kept in a fireworks factory.

The courts are holding that whoever, as employer, is conducting blasting operations owes to his workmen the legal duty of providing safe materials and apparatus, and of instructing the men adequately in the perils involved and the precautions proper. He must tell the men what they are using and how it should be used. This is common sense; it is likewise law. It is well illustrated by a California decision rendered last year in a suit against a quartz mining company. The company in its first blasting operations used gunpowder; but afterward the management adopted Excelsior powder in its place. Yet the workmen continued the practice of tamping the charge with an iron bar. One day there was a premature explosion, and the workman was badly hurt. He sued the company for damages, complaining that Excelsior powder was too dangerous to be used in mines; and that at least a wooden bar ought to be furnished for tamping, and special instructions given, neither of which things had been done. The court told the jury that the proprietors of such works have a right to introduce a more effective powder, though it be more dangerous, provided it is one which experiments and judicious tests have shown to be ordinarily suitable for blasting. But they are bound to furnish any apparatus needful for using the new powder safely; if the cause of the disaster was that a wooden bar was needful and was not supplied, the company was liable for the workman's hurts. And they are bound to give the men judicious explanations and instructions, according to the novelty of the agent; hence if the disaster was fairly attributable to the neglect of the foreman to tell the hands of the change in the powder and the danger of using an iron bar, the company was liable. Upon the other hand workmen who accept employment in blasting take the risk which is inseparable from the business. Even if the risk is increased by introducing a more dangerous powder, the workman, by continuing his service after he has been fairly informed of the change and the danger, agrees, as the law views the matter, to take the additional risks. He is even considered as agreeing to take the risk of any carelessness on the part of his fellow workmen. He is also debarred from claiming damages if he was negligent; thus if this complainant knew from any source that it was imprudent to tamp with an iron bar he ought to have declined to do so.

A similar decision was rendered in New Jersey, last November, in favor of a miner in the employ of the Oxford Iron Company. The president and general superintendent introduced giant powder as a substitute for gunpowder, without giving the men information of the change and the new precautions they would need to use; and an explosion occurred which blinded a workman for life. The court said that he ought to have damages. By hiring himself to the company for duty in blasting he took the risks necessary in that dangerous business, including risk that his fellow workmen might be careless. But he did not agree that a novel and highly dangerous explosive might be substituted without warning to him. The company was bound, when introducing the giant powder in its work, to make known to the men its properties and the right mode of using it. To furnish such an article for a laborer's use without giving him the information, is gross negligence on the part of an employer; and whether the employer or company knows the danger and omits to disclose it, or furnishes the article without knowledge of the danger, makes no difference. The president represented the company in introducing the new powder; and as he clearly neglected the duty of instructing the men, the company must pay damages.

OYSTER NOTES.

One hundred and fifty years ago there were four thousand oyster women in Paris, who pursued their business with much zeal and dexterity.

The "green" oyster, so much prized in France, will not sell in our markets. The "greening" of oysters is extensively carried on at Marennes, on the banks of the river Seudre; and this particular branch of oyster industry extends for leagues along the river, and is also sanctioned by free grants from the State. The peculiar color and taste are said to be imparted by the vegetable substances which grow in the beds where the oysters are cultivated.

A resident of London, England, claims that that city spends over $25,000,000 a year for oysters, and that more than twice the number of these bivalves would be used if they could be obtained at as reasonable prices as in America. The genuine Whitestable oyster fetches about seventy-five or eighty cents a dozen. Oyster culture in England is yet in its infancy. Large numbers of oysters are now carried to England from this country. The most popular size for eating is in a shell about as large as a dollar. They are packed in barrels very closely and kept right side up during the voyage. Quite a trade is now springing up in carrying "seed" oysters to Europe.

Car loads of oysters are shipped to California from New York every few days. The "native" oyster of that western coast is obtained in the Gulf of California, and is small and of coppery taste. There is as wide a contrast between the California bivalve and the Eastern as between a crab-apple and a Rhode Island greening. Something of a supply is being obtained on the Oregon or Washington Territory coast. These are better than the more southern.

The seaboards of Georgia, South Carolina, and Texas abound in oysters. In some places they have grown up into reefs extending for twenty miles along the coast. Much of this oyster wealth may yet become available for Northern markets. Various river mouths and estuaries along the Connecticut and New York shores would be most excellent oyster farms, if some means could be provided to keep the deposits of mud from covering and smothering the young oysters. The time may be near when enterprising men will seek to clear off these ruinous deposits as they now drain marshes and fill up swamps and pools. The recent law of Connecticut creating a State Commission to sell the deep water ground of the Sound, has served to inspire great activity in securing farms in the sea. Many thousands of dollars have already been realized for grounds appropriated.

The production of oysters has more than doubled in quantity in and about New York Harbor, Staten Island, and Perth Amboy during the past five years. It is believed if the mud could be kept out of New York Harbor it would make one of the finest oyster beds in the world.

The natural oyster beds on the east side of Staten Island are the places whence much of the "seed" for all the various famous kinds of oysters about New York is obtained.

It is believed by some that every evil has its antidote. Every pest, sooner or later, can be met by something that will subdue or check it. The potato bug ravaged a few years, and then Paris green came into use, so that they are no longer feared. He would be a benefactor indeed who should discover some cheap and efficient means of stopping the ravages of "stars" and "drills" on oyster beds. Every oyster cultivator says: "Tell us, if possible, how to fight these pests." Here is a field for a scientific scholar. So far it seems to be understood that stars find their homes and breeding places among rocks and reefs. They move out from these upon oyster beds. It has been discovered that dead "stars" are a good means of enriching land. They are capital things to put on the garden. They ruin oyster beds, but enrich vegetable beds. Professor Verrill, of Yale College, says the "star" takes the small oysters into his stomach whole, shell and all; but the larger ones he kills before eating. He does this by surrounding the oyster with the lobes and folds of his enormous saccular stomach. The gastric juice from it is infused into the shell and kills the oyster, so that the bivalve opens and is soon consumed by the rapacious "five finger." The only way yet discovered to destroy this enemy is to dredge them off the beds and throw them on the land.

Science has demonstrated that oysters can be so managed that their spawning seasons can be regulated, and thus good oysters be had and eaten every week in the year. This is arranged in the Connecticut waters by planting them in different depths of water. This secures variety in temperature. The greater the heat the earlier the oysters will spawn. Therefore by moving them into shoal water in a sheltered place where the sun will warm the water easily the spawning season will be over in early summer. Those in the deeper and colder water will, of course, feel the heat later, and therefore spawn later. Thus one portion of the oyster supply can be always ready for use.

STEAM BOILER NOTES.

The boiler of J. J. Cornish's saw mill, near Richmondsville, ten miles northwest of Port Sanilac, Mich., exploded at 4 o'clock P.M., October 6, instantly killing Fred. H. Diehm, who was acting as engineer. The top piece of the south end blew out, striking Diehm, who was standing directly in front, knocking him about ten feet, breaking his neck, bruising his face, and scalding his body above the waist. The owner of this mill made a statement which runs thus: "About half an hour before the disaster I went to see to the boiler and engine, and found them working all right. I told Diehm he must put on the injector about ten minutes, but don't know whether he did or not. Just before the explosion he stopped to oil up and I did some oiling around the saw. Diehm said to me, 'Are you ready?' I said, 'Just about.' He said, 'Hurry up.' I said, 'All right; go ahead,' and looked up. I put my hand on the saw lever, ready for work, and saw him go to the globe valve to turn on the steam. The steam gauge was facing me, and, as I looked up, I glanced at the gauge and saw that it registered sixty-five pounds only. Before the engine had started I saw dust and steam and flying brick, and then heard a deafening report. I knew at once that the boiler had exploded, and ran to where Diehm stood; did not find him, and looked around, but did not see him nor hear him. I thought he was killed. Ten or fifteen feet away to the south, and directly in front of the boiler, the body lay on its face. I never saw him move. I was hit with pieces of brick, but not injured at all. The boiler was stationary, set with brick, and was bought second hand of Bruno Gunt last spring. When bought it tested 200 pounds, which it stood all right." The mill had been burned and rebuilt some time previous to the explosion, and when ready to start the boiler "was tested again the same as at first and stood test all right except around the dome where a number of pin holes appeared. As only sixty or seventy pounds of steam was needed it was thought to be safe. The boiler sets north and south, fronting south. The explosion took the top half of the front out, lifted it clean off the arch and threw it about twenty rods up a hill. It struck on end and turned completely over."

The boiler in Thomas Grady's shoddy dye works at Clifton Heights, Delaware County, Pa., exploded, October 10, instantly killing the engineer, Robert McClure, and wounding several other persons. James Maguire had his collar bone broken, and was sent to the Pennsylvania Hospital. The other wounded were taken to their homes. The mill was partially wrecked by the violence of the explosion, and, taking fire from the coals scattered from the furnace, was totally destroyed.

The Hamilton, Ont., *Times* has the following in relation to the thrashing machine boiler that exploded September 23, and killed Andrew Lloyd and wounded a young woman and two men besides Lloyd. "Mr. Robb, chief engineer of the Canadian Steam Users' Insurance Association, who was commissioned by the Ontario Government to examine the remains of the boiler which burst with fatal results at Thurlow, has completed his inspection, and has prepared his report. After making close examination, he reports that the boiler was evidently well kept, that it was clean, and that there are no signs that the water was allowed to run low. This is a strong point in favor of the engineer. 'The boiler burst,' he says, 'from inherent weakness, being made of poor material.' It was not provided with a first class safety valve, and the valve it has should in justice be called a danger valve."

The boiler at Major's flour mill, Colinville, Ontario, exploded at an early hour on the morning of October 11, wrecking the engine house and saw mill, and seriously scalding William and Headley Major, sons of the proprietor, and William Bickell, miller. About 6 A.M., a fire was started under the boilers, one of which was a tubular and the other a flue, and it was left unguarded while the hands were at breakfast. After breakfast the three men named above went into the engine house, and were standing close to the flue boiler when the tubular one exploded. The cause is not definitely known. The steam gauge, just previous to the explosion, registered 56 pounds. No boiler of ordinary strength, that is, retaining a proper margin over the working pressure, has ever been *known* to explode at 56 pounds per square inch; but a great many have done so at pressures not greater than that, which showed defects of such extent as to excite surprise in the minds of observers that the boiler had sustained even so much as its common load. On the other hand steam gauges do not always tell the truth; they are not only often from 10 to 50 pounds slow, but they are often cut off entirely by obstruction of mud or sediment in the pipe that communicates with the boiler. Again, they sometimes stop at a regular point above which the pointer cannot go from obstructions in the quadrant gear. In short no reliance can be placed on a boiler that is not sound and has not a perfectly reliable and well kept safety valve.

American Success at the Electric Exhibition.

In advance of the official publication of the awards at the International Exhibition of Electricity, the Paris correspondent of the *Herald* cables, October 20, the names of the successful exhibitors from this country.

As a mark of the highest distinction, diplomas of honor have been awarded to the United States Signal Office, the Smithsonian Institution, the United States Patent Office, and Messrs. Edison and Graham Bell.

Gold medals are awarded to the Anglo-American and Brush Electric Light Companies, the United States Electric Lighting Company, Elisha Gray, and Tainter.

Silver medals to Bailey & Puskas, Connolly Brothers & MacTighe, Dolbear, Eccard, Electric Purifier Company, Hubbard Pond Indicator Company, Western Electric Manufacturing Company, Weston Electric Light Company, and the Electro-Dynamic Company.

Bronze medals to Messrs. Chavet, Cumming, and Dion, the Hoosac Tunnel Company, Trinitro-Glycerine Works, Partz, Photo-Relievo Company, White House, Mills and Williams.

If the relatively small number of American exhibitors be considered it will be seen that they have carried off a very large number of prizes. The awards have been made for the *ensemble* of each exhibitor's contribution, not for any single invention exhibited, except, of course, where there was only one.

Ozone at the Electrical Exhibition.

The editor of *Les Mondes* has had a call from Dr. Tommasi, the distinguished Florentine chemist, who came to propose an idea to him that is worth publishing.

The Palace of Industry is at present a place where there is in circulation, especially during the evening, an immense quantity of electricity. Now, under the special and entirely exceptional conditions presented by this vast closed space saturated with electricity, it may be that the atmosphere undergoes peculiar modifications; for example, there may be a production of a certain amount of ozone. It would be extremely interesting, then, to put up an apparatus for collecting the ozone from the air, and which should work continuously at the exhibition. Such an apparatus was proposed by Dr. Tommasi at London seven years ago. The moment seems to us opportune to perform these curious experiments. Dr. Tommasi is all ready to undertake them, but he needs for this the concurrence of some of our learned professors and the kind co-operation of the commissariat of the Electrical Exhibition. We trust that neither will be lacking. Should these experiments take place we will inform our readers of the results obtained.—*Chronique Industrielle.*

MAGIC MIRRORS.—The magic mirrors, which have been a good deal discussed of late, are all of metal. M. Laurent has succeeded in making them of glass, which is sufficiently elastic for the purpose.

COMBINED ANVIL, PUNCH, AND SHEARS.

The engraving represents a novel combination of anvil, punch, and shears, recently patented by Mr H. A. Schnelkloth, of New York city. The anvil is of the usual size and shape, the shank and base portions being hollowed out to receive the shear lever which projects from one end of the anvil, and the punch lever which projects from the opposite end.

The fixed blade of the shears, as well as the female portion of the punching device, is arranged upon strong transverse base portions of the anvil, both being set into dovetailed recesses of the base. The base below the opening of the female die is provided with a hole of gradually increasing width, through which the punchings are readily dropped.

The movable blade of the shears is attached to the front end of a fulcrumed lever, the rear end of which is connected by a strong link to a fulcrumed lever which carries the male die of the punching device. The shear lever is connected by a pivot link with a vertically guided block, in which is formed the socket for the punch, this block being guided by beveled cheeks of the side walls of the anvil, and by an angular front plate.

The link serves to raise the block, while a solid piece, interposed between the block and the end of the lever, serves to press the block down so as to force down the punch. The inner end of the punch lever is provided with a toothed segment which meshes with a pinion keyed to a transverse shaft, and provided with a lever by which either the punch or shears are operated according as the lever is thrown into one direction or the other. This shaft is journaled in bearings of the side walls of the anvil, and carries at its outer end a socket frame into which the handle is inserted and clamped when it is desired to operate either implement.

In this manner a handy and compact combination tool for metal workers, which serves as an anvil, punch, or shears, is obtained, which does not take up more space than a common anvil, and dispenses with separate punching and shearing implements.

The Area of Louisiana.

The United States Land Office makes the area of Louisiana to be 41,346 square miles. Prof. Hilgard, in a census report lately published, puts the figures at 45,430 square miles. The difference is one of 2,607,300 acres. It is more than the combined area of Rhode Island and Delaware. An examination of the State by parishes shows a considerable excess in land over that reported by the Land Office. There are 1,242 complete townships in the State, amounting to 44,712 square miles, besides fractions of others, showing an excess of 3,500 square miles on the lowest calculation. Prof. Hilgard, of the Census Bureau, writes to the New Orleans *Democrat* that he has gone over the figures carefully with the geographer of the bureau, Mr. Gannert, and both are convinced that the Land Office report is wrong. They imagine that the first United States survey found 44,346 square miles; that the second "4" was transcribed as a "1," and that the error has been carried down from year to year, and from book to book, until the erroneous figures have found their way into all the standard authorities.

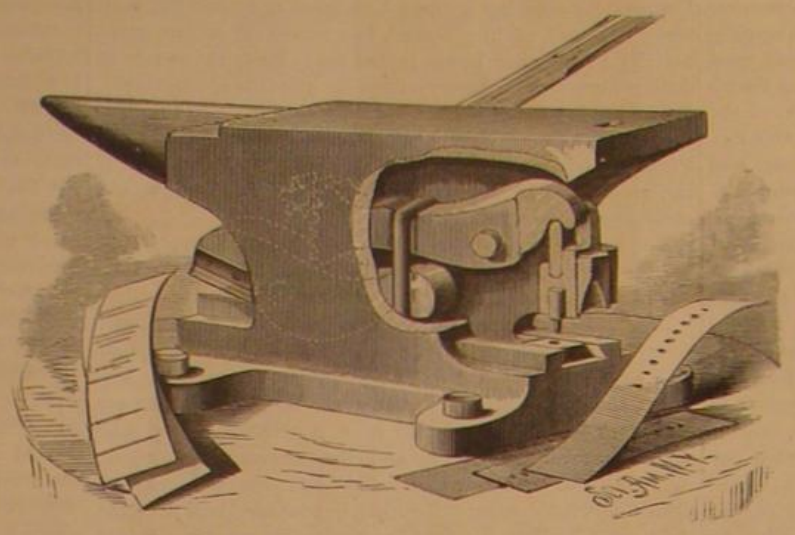
IMPROVED KALEIDOSCOPE.

The engraving shows a kaleidoscope in which the angles of the reflectors and of the figures produced may be varied at will and held fixed in any desired position without turning the instrument, and to design and arrange the bits of glass or other material whose change in position gives rise to the figures of the kaleidoscope, so that when viewed through the kaleidoscope tube they shall present varying tints, shades, and compounds of color and a greatly increased number and variety of figures. The case of the kaleidoscope may be of any desired shape or size.

The ground glass is set vertically in grooves in one end of the case against the inner face of the end plate, which is provided with a triangular opening. A little in rear of the end plate is a parallel vertical partition provided with a corresponding triangular opening, forming the pocket for the reception of the object wheels. The object wheel is made of two or more circular plates of glass held apart and parallel with each other by a hoop so as to form one or more chambers for containing bits of glass or other material for producing the figures of the kaleidoscope. When in place in the case the object wheel rests on the friction disk or wheel secured on an end of a rod which is extended longitudinally through the case along the bottom, and has a knob on its outer end for convenience in turning. By rotating this rod the object wheel is made to revolve.

The tapering reflectors in which the images are formed are centered by a wooden ease, and are drawn together more or less by a roller in the upper part of the case, upon which are wound pieces of cloth attached to the edges of the glass. The cloth and roller not only answer the purpose of varying the angle of the reflectors, but they form the third side of the reflecting tube, excluding light and dust.

Fig. 1 is a perspective view. Fig. 2 is a transverse section. This novel device was lately patented by Mr. V. M. Farr, of Oskaloosa, Ia.

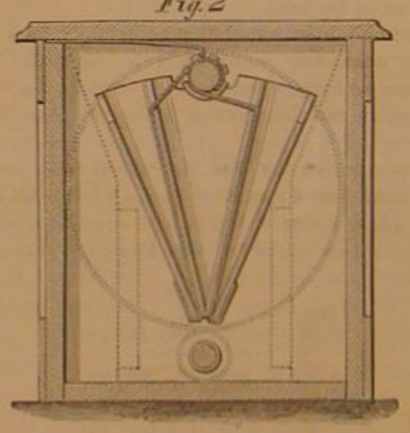


COMBINED ANVIL PUNCH AND SHEARS.

MECHANICAL INVENTIONS.

Mr. John H. Gwinner, of Hughesville, Pa., has patented a shoe-blacking apparatus consisting of a box provided with compartments for slippers, blacking brushes, shoe-dressing bottles, etc., the compartments being provided with swinging lids, to one of which a reversible foot rest, that can be adjusted for right or left handed persons, is attached. The lid of the box has a blacking-box holding frame pivoted to its under side, in which frame the blacking box is held by suitable thumb screws, and the lid is also provided with a rubber bulb containing water, which is conducted by a suitable tube to a nozzle projecting from the underside of the lid, so that when the bulb is compressed a small quantity of water will be squirted upon the blacking box or on the brush.

Fig. 2



TRANSVERSE SECTION OF KALEIDOSCOPE.

Mr. Cyrus E. Grandy, of South Barton, Vt., has patented an improved machine for splitting wood for fuel and other purposes. The machine is driven by power, and is provided with a knife having concave sides which splits the wood completely at every stroke.

Mr. Arthur W. Bush, of Boulder, Col., has patented an improved watchmaker's tool. It has always been a tedious and difficult matter to set a ruby pin or pin jewel properly. The object of this invention is to provide a simple and convenient tool for overcoming this difficulty, whereby the pin may be held in an upright position with the flat side in front.

An improved lock and latch, patented by Mr. Francis Keil, of New York city, is of the class known as "front-door locks," in which the locking bolt, latch, and night latch mechanism are combined in a single case.

Mr. William T. Shaver, of Eldora, Ia., has patented an improved wagon gear especially applicable to spring wagons, the object being to provide a device whereby the usual strain upon the side springs, reach, and head block is avoided and the wagon gear is rendered more elastic.

Mr. James Nuttall, of Heap Bridge, near Bury, County of Lancaster, England, has patented an improvement in machinery for cutting pattern cards for looms. This machine, although simple, cannot be described without engravings.

An improvement in steam engines has been patented by Mr. James H. Suits, of Butler, Ill. The invention consists in the addition of a vacuum chamber to the steam cylinder, with which the cylinder communicates by means of ports corresponding with the cylinder steam ports, the vacuum chamber being supplied with a suitable valve, and being exhausted of residual air and steam by an air pump, so that the steam and air behind the piston at the end of each stroke may escape into the vacuum chamber, and thence be removed by the air pump.

The plug of an ordinary four-way cock is so constructed as to allow supply of liquid through two pipes and escape of liquid through two other pipes simultaneously, but is not adapted to cut off the flow in either direction and simultaneously allow it in the other. Mr. Jackson Sheppard, of Memphis, Tenn., has patented a four-way cock whose plug is so constructed and combined with a shell having four openings or passages that it will allow passage of liquid in either of two directions through the shell, but not in both simultaneously, and may be adjusted to cut off the flow in both directions when desired.

An improved mechanism for converting motion has been patented by Mr. William Hanna, of Gilroy, Cal. This improved mechanism is intended for use as a substitute for cranks in converting rectilinear reciprocating to continuous rotary motion, the special object being to increase the extent of rotary motion from a given length of stroke, while at the same time avoiding dead-centers.

An improvement in machines or frames for twisting fibrous materials has been patented by Mr. William Murray, of Selkirk, County of Selkirk, Scotland. The object is to give double or more twist than is usual by the ordinary machines or frames driven at the same speed and taking but little more power.

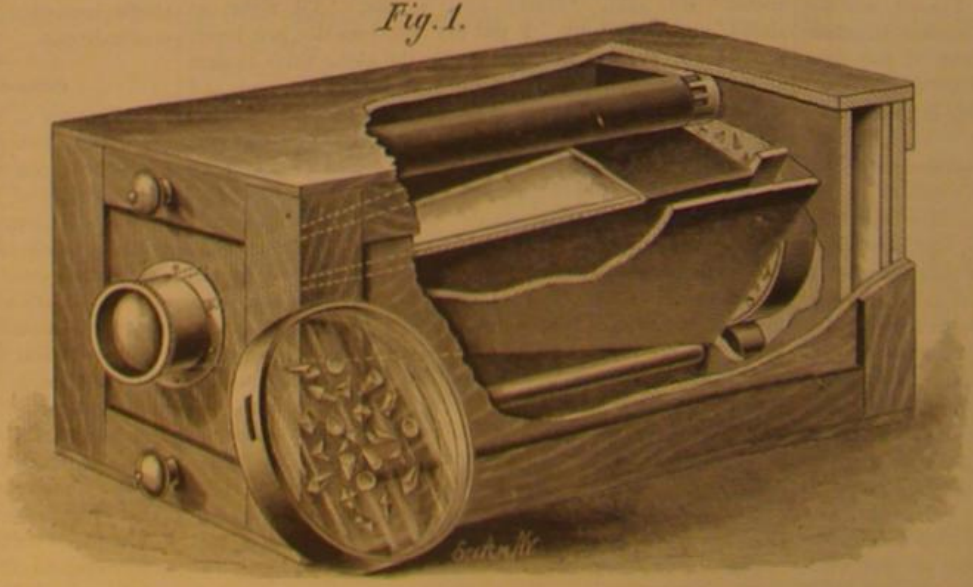
Mr. John D. Smith, of Fayetteville, N. C., has patented an improved attachment to a cotton gin, designed to prevent accidents which so often occur from the contact of the hands and arms of the operator with the saws. In reaching under the arms to brush the moats off the moat board the draught is liable to draw the sleeve up to the saws and involve the laceration or cutting off of the man's arm, and in raising the breast of the gin to clean its ribs while the saws are running the same danger is incurred. To obviate these dangers this inventor provides a guard hung beneath the saws and connected to the breast, so that when the breast is raised the guard is thrown between the saws and the operator and shields him from danger.

An improved vehicle gear has been patented by Messrs. Adam S. F. McBride and Henry D. Haisten, of Cuthbert, Ga. The object of this invention is to provide a gearing adapted to all carriages and of superior elasticity, strength, and durability.

Mr. Henry M. Loud, of Oscoda, Mich., has patented a combined matching and gluing machine, by which the matching and gluing may be performed in a single operation, and the labor and expense of constructing boxes and other articles, where tight joints are required, may be greatly diminished.

Mr. Zadok T. Blackwell, of Carrington, Mo., has patented a new pulley wheel for rope transmission, which is so constructed that the rope cannot slip. A series of pairs of clutches are pivoted to the ends of strips on the sides of a wheel, or the lower ends of these clutches may be pivoted in short notches or recesses in the edge of the wheel. The inner or adjoining edges of these clutches are curved from the base upward and outward, and are provided with shoulders or offsets which overlap each other. The driving rope passes around the wheel and rests in between the clutches and on the shoulders or directly above them. If the rope presses on the shoulders the two jaws are forced together and the rope is jammed in between the edges of the clutches and held.

Fig. 1.



FARR'S KALEIDOSCOPE

NEW INVENTIONS.

In coating wire with tin or zinc the usual method for removing the surplus tin or zinc from the wire as the latter leaves the bath, is to draw said wire through a covering of sand, asbestos, or other non-combustible substance that is placed on the surface of the bath; but in this method tubes of scoriæ are quickly formed by the passage of the wire through the sand or asbestos, so that the latter ceases to wipe off the surplus molten tin or zinc, or does so imperfectly, and when in operating upon a number of wires at a time the sand or other material about one wire becomes dirty or ineffective from scoriæ or from the surplus metal that is wiped from said wire, all the wires have to be stopped to replace the dirty with clean sand. Messrs. John A. Crich, of Naugatuck, Conn., and Frederick Crich, of Pittsburg, Pa., have patented a device free from these objections, that will rarely require the changing of the sand or other wiping substance, and that is so arranged that the sand can be removed and replaced about one wire, when desired, without interfering with the other wires.

Mr. William B. Collier, of Ellicott City, Md., has patented an improved dredging machine, more particularly designed for dredging oysters or other shellfish. This invention consists in an inclined endless rake composed in part of an endless slatted apron provided with hooked tines and passing round upper and lower drums, the former of which has its bearings in the stern of a vessel and is rotated to drive the apron, while the lower drum rests upon the water bed and is hollow and water-tight to give buoyancy to the dredge. A stationary rake having spring teeth is arranged at the lower end of the frame of the endless apron to assist in raising the oysters on to the curved teeth of the endless rake, which delivers the oysters into the vessel free from mud or dirt.

An improvement in overalls has been patented by Mr. Bernhard Guttman, of Plainfield, N. J. The object of this invention is to facilitate converting ordinary open front overalls into apron overalls, which cover and protect the breast of the wearer. The invention consists in an apron provided with suspenders and adapted to be attached to the waistband of the overalls in such a manner that it will cover and protect the breast of the wearer, the suspenders holding the apron in this position.

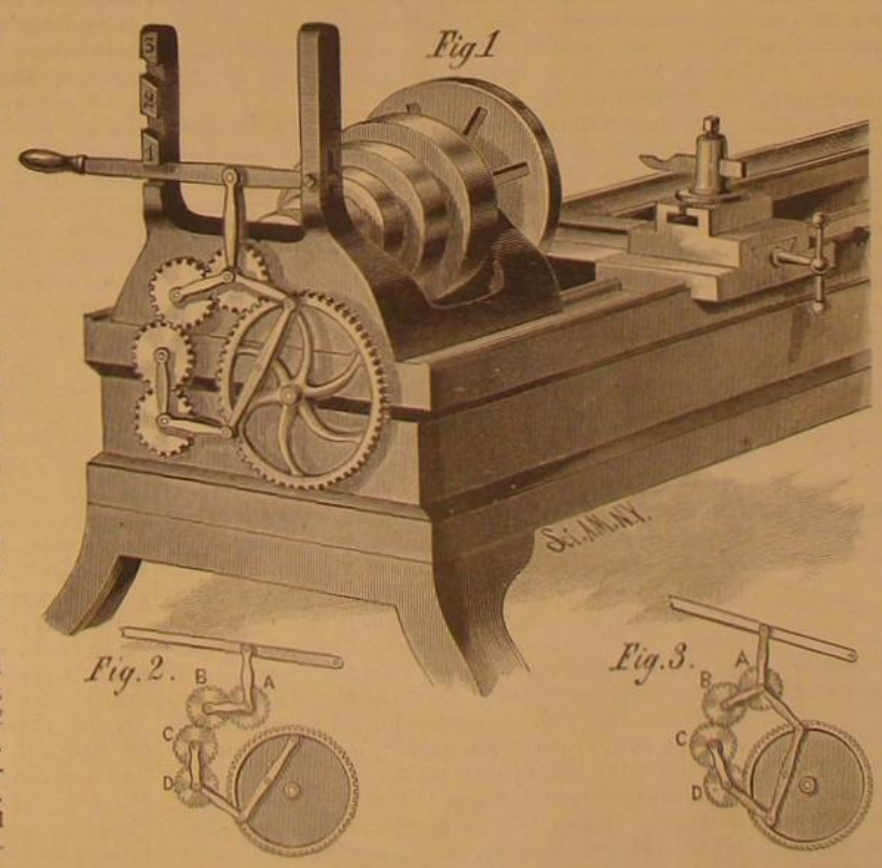
NEW DEVICE FOR OPERATING THE TOOL RESTS OF LATHES.

The engraving represents a new form of reversible feed gearing for engine lathes, recently patented by Mr. George Moll, of Mascoutah, St. Clair county, Ill. The object of the invention is to provide a device by means of which the feed mechanism of a lathe may be readily reversed or stopped.

Fig. 1 is a perspective view of the end of a lathe with the improvement attached. Figs. 2 and 3 represent the gearing in different positions.

The body of the frame of the lathe, the tail block, and the traveling tool rest may be of any suitable construction. The main gear wheel is secured to the end of the feed screw in the usual way, and receives its motion from the lathe spindle through the wheel, C, and the intermediate wheels, A, B, D. These wheels are all simultaneously controlled by means of the link mechanism shown, the rocking lever, and the main hand lever. The link mechanism consists of the link which connects the wheels, C D, the link which connects the wheel, A B, with the upper end of the pivoted lever, E, the link which connects the wheel, D, with the driving wheel, C, the link which connects the wheel, D, with the lower end of the pivoted lever, E, and the link which connects the whole with the main hand lever.

When the main hand lever is raised to its highest point the wheel, A, will be lifted out of contact with the wheel on the feed screw, and the wheel, D, will be brought into engagement with the main wheel, as shown in Fig. 3, and thus impart forward motion to the tool rest. When the lever is brought to its lowest point the wheel, D, will be carried out of contact with the main wheel, and the wheel, A, brought in contact with it, and thus impart a reverse movement to the tool rest. When the lever is brought to the intermedial point both wheels will be moved out of contact with the main wheel, as shown in Fig. 2, and the tool rest will remain still. The inventor informs us that this improvement is favorably received by machinists, and that it saves a great deal of time in mechanical operations requiring a reversal of the feed motion of a lathe.



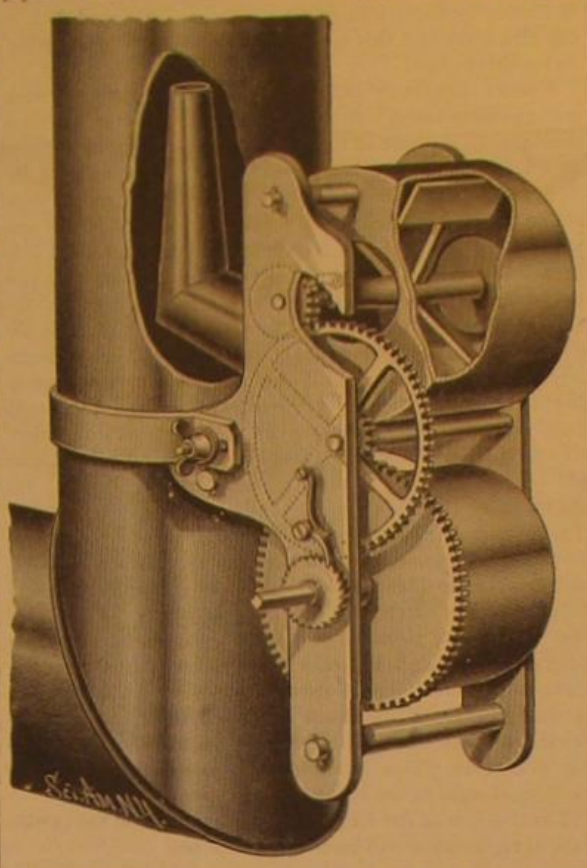
MOLL'S REVERSIBLE FEED GEAR FOR LATHES.

New Voting Apparatus.

Mr. Anthony C. Beraneck, P. O. Box 11, Englewood, N. J., has recently patented an improved apparatus for registering votes. The machinery of the apparatus is connected to the door of the apartment, and each opening sets the machinery so that a pressure on the knob or key will register one vote. The invention is ingenious and simple.

NEW DRAUGHT APPLIANCE FOR STOVES.

The annexed engraving represents a blower for creating a draught in stoves, chimneys, flues, ranges, furnaces, and engines, or anything or place where a blast draught is required. The machine winds up like a clock, and runs for any length of time, according to size of machine. It is easily attached to a stovepipe by a band surrounding the pipe. A hole can be made in a stovepipe and the blow pipe



BEAUMONT'S DRAUGHT APPARATUS FOR CHIMNEYS AND FLUES.

inserted so as to point upward, giving a powerful draught to the stovepipe or chimney and keeping them free from soot. By using this appliance any stove may be made to burn green and wet wood readily, creating a quick, hot fire with a much smaller quantity of fuel than a slow fire requires.

With this device any kind of coal and coke may be burnt. This apparatus is of special advantage when kindling a fire, and when it is desirable to produce a quick hot fire for any purpose. When the blast is no longer needed the machine may be stopped by dropping a pawl or dog into the teeth of the pinion on the fan shaft.

For further information address Fred. Beaumont, Jr., patentee, southwest corner of North and State streets, Little Rock, Ark.

Dangers of the Electric Light.

It is reported that the disastrous fire at the Landenberger Mill, Philadelphia, on Wednesday night, had its origin, as the local journals express it, in the "unaccountable flickering and sparks from the electric lights used in the establishment." If these statements be correct, it becomes a matter of no inconsiderable importance to ascertain from the scientists how far these eccentricities are likely to be permanent conditions of the use of these lights in other establishments. It is a serious business thus to have life and property at the mercy of their scintillations.—*Phila. Bulletin.*

There is more or less danger of the falling of sparks from all electric lights. Any imperfection in the carbon or irregularity in the driving engine will produce snapping and sparking. A simple safeguard is to place a glass cup around or under the carbon to catch the sparks.

Molecular Attraction.

BY F. D. BROWN, B.SC.

The author points out that if we regard chemical affinity as neutralized by the union of two elements, we are then unable to account for the reactions taking place between molecules, and involving an interaction of the atoms composing different molecules. If, however, the act of combination be regarded as producing no change in the chemical forces, and it be supposed that the same attraction is exerted between any *given* pair of atoms without regard to the state of combination of one or both of the atoms, then a reasonable account can be given of chemical reactions, and the existence of molecular combinations does not appear very remarkable. Further, we are provided with a more or less effective explanation of the relative volatility of substances. Reasoning from this point of view, and considering the carbon compounds specially, the author concludes that intermolecular attraction should be greater in an acid than in a corresponding alcohol; greater in an alcohol of high molecular weight than in a homologue of which the molecule is less complex; greater in a primary alcohol than in the secondary or tertiary isomeride; and finally, greater in a chlorinated compound than in the corresponding substance containing hydrogen. If the volatility of a substance be a measure of the forces of attraction between the molecules, then it must be admitted that the boiling points of organic compounds show with some reason that the above expression represents the value of intermolecular attraction. From this point of view the study of the latent heat of many carbon compounds would materially aid us in the solution of the problem of chemical affinity.

Visions in the Clouds.

Displays of aurora borealis are evidently infrequent in Delaware, Maryland, and Virginia. The local papers of the latter part of September and the first week in October contain numerous references to marvelous visions in the clouds, and exhibit a mediæval condition of popular intelligence in the rural districts scarcely less marvelous. The Warrentown (Va.) *Solid South* says: "A number of reliable and responsible people, whose names we can give, about a week ago, saw an apparition in the heavens, about 10 o'clock P.M., of white robed figures, which were supposed by those who saw them to be angels. It is all the talk of the people in and around the villages of New Baltimore and Buckland." The Richmond *Dispatch*, of the 7th, prints a note from Mr. M. C. Grasty, of Fredericksburg, Va., dated 5th inst., in which he says: "Many persons in this community claim to have witnessed a most alarming sight in the heavens some nights since, just before daybreak. The heavens are said to have been lighted, and vast numbers of soldiers appeared, uniformed, armed, and drilling. Who else saw it, and what is the explanation? Could it have been a mirage?"

Similar observations were made further north. A Wilmington, Del., dispatch says: "The people in this vicinity are greatly excited over what they believe to be supernatural manifestations. A little girl, some three weeks ago, living in the village, saw after nightfall, before the moon was fairly up above the horizon, platoons of angels slowly marching and countermarching to and fro in the clouds, their white robes and helmets glistening in the light. At intervals the heavenly visitors would dance mournfully. Her father also saw the spectacle. Monday night, two weeks ago, William West, a farmer living near Georgetown, the county seat, saw bands of soldiers of great size, equipped in dazzling uniforms, their muskets shimmering in the pale, weird light that seemed to be everywhere, marching with military precision up and down, and presenting arms. The vision lasted long enough to be seen by a number of West's neighbors. Many people living near Laurel, many miles away, situated in the lower end of the Peninsula, saw the same extraordinary phenomena. A few go as far as to say that they distinctly saw in the midst of the soldiers, and conspicuously by reason of his size and commanding presence, the hero President himself, with every feature distinctly and vividly portrayed. In Talbot county the illusion was seen by numbers."

MR. CHARLES VAN BENTHUYSEN, of Albany, who died in this city, October 19, is said to have been the first printer in this country to introduce steam power in printing. The engine with which this important experiment was made is still in the possession of the family.

MISCELLANEOUS INVENTIONS.

Mr. Henry Reny, of Lewiston, Me., has patented an improved valve for musical instruments, such as trumpets, cornets, etc., which has a smaller stroke than the similar valves in use heretofore, and is therefore much more convenient for the musician or performer.

Mr. Aaron S. R. Overholt, of West Overton, Pa., has patented a nut locking device for fish joints of railroad rails. It consists of a gib keeper formed to fit snugly into the recesses formed by the top of the rail flange and the lower side of the nut and to clasp firmly the two sides of the nut; and also in a metallic tinned washer, by which the gib keeper is secured and maintained firmly in place within the recess in such a manner as to effectually prevent the jarring out of the gib or the unscrewing and loosening of the nuts by the jar incident to the traffic upon the road, and to provide for the removal of the gib as occasion may require.

An improved washing machine, patented by Mr. Robert D. Bennett, is so made as to allow the introduction and removal of the articles operated upon without removing the rubber from the tub. This invention consists in hinging one end of the rubber to radial arms extending from the shaft, and providing the other end with hinged bolts engaging in slots in other radial arms, whereby the said rubber may be lifted from one end for the introduction and removal of articles and then secured in place. This machine is intended to imitate handwork. Any information in regard to it may be obtained by addressing Mr. Marcius Bibbero, New York city.

Mr. Charles Oliver Chaplin, of Ridgeway Corners, Orleans Co., N. Y., has patented a fruit drying apparatus, which comprises a drying chamber heated by a furnace arranged at one end of the latter, and an endless chain of pendent grooved carriers for the support of trays on which the fruit to be dried is placed, said endless chain engaging and disengaging with notched wheels within the drying chamber, and being supported by wheels which run upon suitable upper and lower tracks. The invention consists in various peculiarities of construction and combinations of parts, whereby increased facility is afforded for tempering the heat of the drying chamber, for giving an easy traveling action to the trays through said chamber, and the top of the furnace compartment not only supports the furnace but serves as a stand for the operator in introducing and removing the fruit trays; also provision is afforded for charging the furnace through its top.

An adjustable trace loop has been patented by Mr. William G. Riley, of Corydon, Iowa. The object of this invention is to provide a simple and inexpensive loop for attaching a back band of a harness to a trace in an adjustable manner, so that the back band can be easily moved forward or backward, as well as lengthened or shortened, to accommodate horses of different sizes. To these ends the trace loop, which is adjustable both vertically and laterally, has deep rectangular recesses cut crosswise at its center to provide for a snug hold of the trace, and is furnished with a narrow central pin plate, which affords every facility for adjustment of the back band.

An improved feathering propeller has been patented by Mr. Alexander Davidson, of Springfield, Ill. The invention consists in a paddlewheel provided with pivoted oscillating rectangular bucket frames having longitudinal supporting bars and cross bars to resist pressure, in connection with oscillating buckets. It also consists in a combination with the main frame of a paddlewheel of bucket frames controlled by eccentrics and supporting oscillating buckets which are hinged to the forward part of the frame and have their rear edges free to vibrate, whereby the buckets when propelling are held at right angles to the line of progression and assume the position of least resistance when feathering. This propeller is readily adaptable to both deep and shallow water, may be arranged to work either vertically or horizontally, and be only partially immersed or wholly submerged.

TRADE MARK DECISIONS BY THE COMMISSIONER OF PATENTS.

EX PARTE FRIEBERG & WORKUM.

Appeal from the Examiner of Trade Marks.

TRADE MARK.

Marble, Commissioner:

Appeal is taken from the decision of the Examiner of Trade Marks in refusing to register as a trade mark subject-matter described as follows:

The words "J. A. Bowen" and the arbitrary symbols of a shield on which is emblazoned the arms of the United States. These have generally been arranged as shown in the accompanying facsimile, the words "J. A. Bowen," in a curved line, forming the upper part of a circle, and the word "Bourbon," in an inverted curved line, forming the lower part of a circle. Between these words is the representation of a fancy shield, upon which appears the Stars and Stripes, that form the conventional armorial bearings of the United States of America; but the word "Bourbon" may be omitted without materially altering the character of our trade mark, the essential features of which are the words "J. A. Bowen" in connection with the shield having emblazoned thereon the Stars and Stripes, that form the conventional armorial bearings of the United States of America, the whole surrounded by a plain circular border.

It is stated in the application that this alleged trade mark has been continuously used in the business of the applicants as a trade mark on whisky since the year 1857. The application was rejected by the Examiner because applicants refused to erase therefrom the words "J. A. Bowen," the attorneys of applicants having admitted that he was the person whom the applicants succeeded in business. The Examiner's objection to the registration of said trade mark is stated as follows:

Their use of this name is evidently intended to inform the public of the fact that they are the successors in business of J. A. Bowen, and are now engaged in the distillation of liquors formerly sold under his name. It would seem to the Examiner that this is simply a transfer of "good will," and nothing more.

A trade mark is an arbitrary character or characters without special meaning, adopted by persons, firms, or corporations for the purpose of identifying the goods manufactured by them or of which they have the sale. Persons have the right to adopt any device or form of words possessing these characteristics as their trade marks so long as public propriety is not violated. It may be true in this case, as it is in many cases, that the name of a person associated with a particular trade or business carries with it the good will of the establishment with which he was connected. If it is the good will simply that is sought, then it should not be registered as a trade mark; but if the name of a person possessing the characteristics of a trade mark in itself, not an applicant, is adopted by any person, firm, or corporation to identify their particular goods, I see no good reason why it may not be used as a trade mark and be registered as such. On the contrary, there are many reasons why it may be so used. The long use of the name of a particular person with a particular class of goods manufactured by that person or in his name, serves to identify those goods as particularly as any other character, device, or collection of words. This is all that is required to make it a legal trade mark. Whether persons other than the person whose name is used have the right to use such name is another question. In this case it is claimed that the applicants have used this name with the device mentioned as their trade mark upon their goods since the year 1857. This is sufficient *prima facie* evidence of their legal right to use it.

The decision of the Examiner is overruled, and the certificate of registration will issue in due course.

Frederic Sauvage.

The London *Times* gives a sketch of the life of Frederic Sauvage, to whom the people of Bologne have just erected a statue, as the inventor of the screw propeller. His claim to this honor rests on the fact that in 1832, hearing that the French Government proposed to build a number of paddle steamers, he was led to devise a better means of propulsion, and eventually he constructed a screw.

Early in that year Sauvage exhibited to the Boulogne authorities his new invention, which was highly approved. As he was anxious to bring it under the notice of government, he gave up his Boulogne residence and left for Paris, where he took out a patent for fifteen years. The screw was acknowledged to have its advantages with small boats, but the commissioners, who sat by order of the Minister of Marine to report on it, concluded that it would be of no use for large vessels.

The English Government, in 1835, it is stated by the *Times*, offered him a sum for the invention, on the condition that it was to become the exclusive property of England, but the inventor, who was at that time stricken down by poverty, would not consent. It is further said that Sir Francis Pettit Smith derived his first idea of a screw from a visit to Sauvage's workshop.

In 1841 Sauvage made an agreement with a shipbuilder and an engineer for the construction of a steamboat, to which the screw was to be fitted, he giving the plans, while they carried them out, and at their own expense, but the agreement, owing to a technical misunderstanding, was badly worded. The boat was built and fitted, but not as Sauvage wished, and the two others took all the credit. The unlucky inventor, forsaken by all, after many years of toil, was, in the year 1843, shut up in the debtors' prison at Havre, where he remained some time, but was eventually released through the instrumentality of Alphonse Karr, who had taken a deep interest in him. From the time he had set on foot his experiments with the screw, he had spent in the course of ten years about 80,000 francs (£3,200), in exchange for which he afterward received from the State a yearly grant of 2,500 francs (£100). Driven to despair, and in deep misery, Sauvage, who was advanced in years, was conveyed in April, 1854, to the Picpus Asylum, where he passed the remainder of his life, dying at the age of 71.

The townpeople of Boulogne, in 1872, through the mayor, M. Auguste Huguet, had his remains removed from Paris and interred in the cemetery, where a monument surmounted by a bust was erected to his honor.

It is probable that Sauvage's claims will receive but little attention outside his own country. In England, it will be remembered, in 1770, James Watt, writing to Dr. Small, proposed to use one of his steam engines to drive a screw for the propulsion of a ship. In 1776 the American, Bushnell, described a submarine boat propelled by a screw. Trevithick patented a screw propeller in 1816; and before him, in 1800, Edward Shorter patented a propeller, which was afterward, in 1802, tried on H. M.'s ships Dragon and Superb. In America, Stevens, in 1804, tried to propel a boat by a screw. In 1816, Millington described a screw with a very ingenious steering arrangement connected to it, and this was apparently the first of a great number of attempts which have been made in that direction—all, as yet, unsuccessful. From this date till the date of F. Pettit Smith's invention (1836), the records of the Patent Office show that many minds were working in the same direction. The point of Smith's invention was the placing of the screw propeller in the dead wood of the vessel, nor has it ever been claimed for Smith that he was the inventor of the screw propeller, though he was, there seems little doubt, the one to bring it into actual use. There seems little question that Sauvage did nothing more than was done by very many others—by Watt, Trevithick, and the rest—conceived a most valuable idea, but never carried it beyond the stage of a model.

Sylvester Doolittle.

One of the pioneers of American internal commerce, Sylvester Doolittle, died recently in Oswego, N. Y., in his 82d year. Mr. Doolittle built and owned the first canal boat that made the trip from Rochester to Albany. It was called the Genessee of Wheatland, and carried a cargo of flour. This in 1822. For several years Mr. Doolittle built packets and freight boats, and in 1826 removed to Utica, where he built, owned, and commanded the first canal boat that passed down the Hudson River to New York. She was called the City of Utica, and carried oats and lumber. In those days all the Hudson River lines carried freight, and none of them would tow his boat to New York. At length he induced a Mr. Hitchcock, who owned a small steamer running independently of any line, to tow him. He moored at Coenties Slip, and his queer craft was visited by many curious New York merchants. He reloaded with merchandise, which he delivered at Utica, and soon towage of canal boats to New York became a large business, which it still continues to be. When the railroads destroyed the packet business Mr. Doolittle removed to Oswego and built vessels for the lakes.

In 1841 Ericsson's screw propeller engaged his attention. Ericsson met with little success in introducing it, and in consideration of Mr. Doolittle's putting it in one of his boats, agreed to give him the right to use it in all the vessels he might build in three years. Mr. Doolittle immediately built the propeller Vandalia, the first screw wheel steamer that sailed the lakes. She made her first trip through the Welland Canal to St. Catharines at a speed of six miles an hour. Crowds of people turned out to see her, and a public dinner was given Mr. Doolittle at St. Catharines. The next year he had a line of five propellers on Lake Ontario, and soon they were on all the lakes.

The Land Slip at Elm, Switzerland.

In the recent disaster at Elm—otherwise known as Unterthal—a great mass of earth and rock from the Plattenberg or Tschingler Alp, 1,500 feet wide, at least 2,000 feet high above the valley, and, according to the engineers, from 60 to 100 feet deep, fell over upon the village, its farms, gardens, and meadows, covering several thousand acres. Tons of rock were dashed entirely across the valley, and now rest quietly 300 and 400 feet high upon the hillside. The air pressure was so great that houses were lifted up from their foundations and carried a distance of 1,000 feet. A barn built of heavy logs, and filled with hay, was carried entirely across the valley and overturned 200 feet high on the mountain opposite the Plattenberg. An iron bridge which crossed the Sernf was torn up, carried scores of feet away from its abutments, and now rests on end more than half buried in mud and loose stone. The whole valley, as far as it can be seen from the village inn, which is still standing, very closely resembles the bed of a glacier which has receded.

The river Sernf has made for itself a new channel through the *débris*, and has flooded and ruined much of the land below, land which was not directly harmed by the avalanche of stone. So in one way or another the whole valley has been injured beyond all hope of repair. The loss in property will reach not less than 2,000,000f.; at the lowest estimate 123 people have lost their lives; other estimates make the number 150 or more. The state engineers, fearing further land slides, have forbidden those who have escaped to return to the houses which remain standing, and in consequence more than 800 men, women, and children, who but a few days before were prosperous and well-to-do, are now almost without a roof to cover them.

The chief cause of the disaster, after the heavy rains of the past summer, is said to have been injudicious quarrying for slate, whereby the mountain was in part undermined and so rendered unsafe. Some three years ago ominous signs of danger were observed, and the cantonal forest master, Herr Seeli, warned the proprietors of the quarries that they were carrying on their excavations beyond the bounds of safety. The work went on without interruption until Thursday, Sept. 8, when the premonitions of disaster became so alarming that all the men were withdrawn from the quarries; yet no one seems to have thought the village was in danger until Sunday afternoon, when, as the people were coming from church, a quantity of stones, rolling from the Tschingler, crushed several houses in Unterthal nearest the foot of the Alp. Ten minutes later came the great catastrophe; a thunderous noise rent the air, a black dust-cloud overspread the valley, and all was still. In those two or three seconds Unterthal had disappeared, and with it were buried nearly every one of the unfortunates, who a few minutes previously were worshiping in the village church. Scarcely any, in fact, who on the first alarm crossed the Sernf, either out of curiosity or fear, to lend a helping hand to those whose houses had been struck, escaped, and they include nearly all the manhood of the village. Forty dwellings, the best in the village, were buried.

This is not the first disaster of the sort in Switzerland, nor anything like the worst. On the 4th of September, 1618, the rich though small town of Plurs, in the Grisons (near the Engadine valley), was entirely buried by a land slip. Over 2,400 persons lost their lives. The site is now occupied by a fine forest of chestnut trees. No remains of the town have ever come to light, with the exception of a bell which belonged to the church, and which turned up twenty years ago.

On the 2d of September, 1806, the Rossberg, a mountain some miles to the north of the Righi, gave way on its eastern side, and slid down into the lake of Lowerz, which is half filled up, converting the once picturesque slope, studded with chalets, pasturages, and herds of cattle, into a chaotic mass of mud and rock. 111 houses and 457 persons were overwhelmed and seen no more.

The occurrence of all these catastrophes in September points to a common cause, the overcharging of the steep mountain slopes with water after periods of unusual rain.

The Brooks Denning Comet.

The new comet in Leo, discovered independently by myself, on the morning of October 4, at 2 hours 45 minutes —civil reckoning—and by Mr. Denning, of England, the following morning, has been observed at the Harvard College Observatory and at Dun Echt, Scotland.

From these observations Prof. S. C. Chandler, of the Harvard Observatory, has computed and just sent me the following elements and a finding ephemeris:

ELEMENTS.

Perihelion Passage, 1881, September 3.47. G. M. T.

Long. Perihelion, 20° 15′ } Eq. 1881.0.
Long. Node, 82 29 }
Inclination, 10 25 }

Log. Perihelion Distance, 9·8605.

Motion direct.

EPHEMERIS.

Wash. midnight, 1881.	R.A. h.	R.A. m.	R.A. s.	Decl. °	Decl. ′	Log. r.	Log. △.	Light.
Oct. 12.	9	41	12	+14	50	0·0222	0·0636	0·71
16.	9	49	24	14	53	0·0438	0·0751	0·61
20.	9	57	4	14	56	0·0648	0·0857	0·53
24.	10	4	0	+15	0	0·0858	0·0946	0·46

Light on October 4 is taken as unity.

On the 20th and 24th inst. the comet will be just above and within three degrees of Regulus, and will move very slowly eastward from that point. It is growing fainter, being at the last named dates about one-half as bright as when first seen at my observatory. It is suggested by Mr. Chandler that it may prove to be a periodic comet of about six years eleven months, and observations with large telescopes will be of great value in determining this interesting point.

It was well seen by me at discovery, in the absence of moonlight, with a telescope of five inches aperture.

WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y.,
October 15, 1881.

A Singular Accident.

The engine house of the Nightingale Brothers' silk mill in Paterson, N. J., was demolished by the bursting of a flywheel, October 19. Pieces of casting weighing five or six hundred pounds were thrown half a block away, but fortunately no lives were lost. The engine, of about 100 horse power, had lain idle for years, a smaller one having been used since the mill was turned from a cotton to a silk factory. The addition of new machinery, however, required the use of the big engine for additional power, and machinists had been at work on it several days. On Tuesday afternoon it was run experimentally, and seemed to go all right. The governor was arranged for it to make 60 revolutions a minute. Wednesday morning, when the fireman started up the boilers, the engine started off on its own account and could not be stopped, as the steam supply valve was already closed, and there was no apparent reason for its going. It continued to increase its speed until it was estimated that it was running at the rate of 150 revolutions a minute. The limit of safety was considered to be 75 revolutions. In alarm the few men about the building fled for their lives, except fireman Carlough and a workman named James Killen, who were still trying to turn off the steam valve, when the flywheel broke and the pieces flew in every direction. The flywheel was 15 feet in diameter, and weighed eight tons. The engine house, which was about 30 by 15 feet and two stories in height, was almost demolished. The cause of the engine's sudden starting was discovered to be a fracture in the seat of a new supply valve in the main steam pipe leading to the engine. In shutting off steam on Tuesday night it is supposed the pressure broke off the fractured seat, which left the pipe open for the passage of steam from the boiler.

Another Keely Motor Exhibition.

Keely has just given another exhibition of his celebrated motor, or, rather, of a combination of cylinders, plungers, pumps, globes, and connecting rods, somewhere within which his motor was alleged to be at work. The trial was a very peculiar one. This motor has been threatening, for the last six years, to run a train of cars to New York and a vessel to Liverpool on about a cupful or bucketful of water. What Keely actually did was to turn a wheel, as one experiment; to fire a bullet through three inches of plank as another; and to perform two or three other trivial feats, any of which could be produced by a very ordinary use of very familiar forces. When it is added that the exhibition was given in Keely's own workshop, and that the room directly underneath, also occupied by him, was kept locked and bolted, and that he refused, in some confusion, to allow his visitors even to look into it, the value of the trial is obvious. To make the thing complete, the inventor, before each experiment, scraped a large tuning fork with a fiddle bow, in order to get the right pitch for the motor, which was hinted to be derived from the force of cohesion. Instead of the presto! agrimento! change! of mere conjurers, Keely gave an explanation that, by means of the introductory impulse and the fifth compound, he so impinged on the molecular lead as to disturb the equilibrium, and then to multiply the atomic ether or liberated interatomic impulse. The only thing in the workshop, visible or invisible, which the assembled party seemed to understand, was the collation. But there is no denying the fact that by dint of some qualities Keely has kept this sort of thing going for six years, and that he still finds stockholders who have abundant faith in him.—*N. Y. Sun.*

New York Board of Health Rules for Plumbers.

Under the new law for the registration of plumbers and the inspection of plumbing by the Board of Health, the board has adopted the following regulations:

Whenever any plumbing work is completed, and before it is covered from view, the board must be notified in order that it may send an inspector. The arrangement of soil and waste pipes must be as direct as possible. The drain, soil, and waste pipes and the traps should, whenever practicable, be exposed to view for ready inspection at all times. When placed within walls or partitions they should be covered with woodwork fastened with screws, so as to be readily removed. In no case should they be absolutely inaccessible. Every house or building must be separately and independently connected with the street sewer by an iron pipe calked with lead. The house drain must be of iron, with a fall of at least half an inch to the foot if possible. It must be provided with a running trap placed at an accessible point near the front of the house, and there should be an inlet for fresh air entering the drain just inside the trap of at least four inches in diameter, leading to the outer air, and opening at any convenient place not too near a window. No brick, sheet metal, or earthenware flue shall be used as a sewer ventilator, nor shall any chimney-flue be used for this purpose. Every soil pipe and waste pipe must be of iron, and must extend at least two feet above the highest part of the roof or coping, of undiminished size, with a return bend or cowl. Horizontal soil and waste pipes are prohibited. All iron pipes must be sound, free from holes, and of a uniform thickness of not less than one-eighth of an inch for a diameter of two, three, or four inches, or five thirty-seconds of an inch for a diameter of five or six inches. Before they are connected they must be thoroughly coated inside and outside with coal tar pitch, applied hot, or some other equivalent substance. Iron pipes, before being connected with fixtures, should have openings stopped and be filled with water and allowed to stand twenty-four hours for inspection.

All joints in the drain pipes, soil pipes, and waste pipes must be so calked with oakum and lead, or with cement made of iron filings and sal-ammoniac, as to make them impermeable to gases. All connections of lead with iron pipes should be made with a brass sleeve or ferrule, of the same size as the lead pipe, put in the hub of the branch of the iron pipe, and calked in with lead. The lead pipe should be attached to the ferrule by a wiped joint. Every sink, basin, wash tray, bath, safe, and every tub or set of tubs must be separately and effectively trapped, and the traps must be placed as near the fixtures as practicable. Traps should be protected from siphonage by a special metallic air pipe not less than one and a half inch in diameter. Every safe under a washstand, bath, watercloset, or other fixture must be drained by a special pipe not directly connected with any soil pipe, waste pipe, drain, or sewer, but discharging into an open sink upon the cellar floor or outside the house. All watercloset inside the house must be supplied with water from a special tank or cistern, the water of which is not used for any other purpose. The closets must never be supplied direct from the Croton supply pipes. A group of closets may be supplied from one tank, if on the same floor and contiguous. The overflow pipes from tanks should discharge into an open sink or into the bowl of the closet itself, not into the soil or waste pipe, nor into the drain or sewer. When the pressure of the Croton is not sufficient to supply these tanks a pump must be provided. Rain water leaders must never be used as soil, waste, or vent pipes, nor shall any soil, waste, or vent pipe be used as a leader. No steam exhaust will be allowed to connect with any soil or waste pipe. Cellar and foundation walls should be rendered impervious to dampness by the use of asphaltum or coal-tar pitch in addition to hydraulic cement. Yards and areas should always be properly graded, cemented, flagged, or well paved, and drained by pipes discharging into the house drain. These pipes should be effectively trapped.

A Steel Tube for the English Channel.

A grand scheme is said to be in contemplation for crossing the English Channel. A line of steel tubes, sixteen feet in diameter, is proposed, to be sunk and firmly anchored at a sufficient depth below the surface to be out of the way of navigation. It is to be ballasted to overcome the buoyant effect, and secured to sunken caissons by chains.

Superheated Steam.

BY PROF. S. N. CARVALHO.

The vast and continuous increase in the use of steam for motive purposes, particularly during the last twenty years, and the consequent enormous consumption of coal (85,000,000 of pounds per annum) have furnished an incentive to inventors in this direction second to no other of modern times. The well understood fact that the most economical form of steam engine yet devised—considering the boiler and engine as a whole—renders us in useful energy but about 15 per cent of the true energetic value of the fuel consumed therein, presents the considerations of any improvement that may transmute into useful power some greater proportion of the heat evolved by the combustion of fuel, as the most important problem of the present day.

Superheated steam has been demonstrated by the most distinguished engineers, from Watt down to the present day, as the best means of preventing "cylinder condensation," to which has been attributed the true cause for the enormous loss sustained in the use of the steam engine by the present method of using saturated steam. The way this loss occurs is exemplified as follows: With a cylinder in which steam at half-stroke, or 50 per cent cut off, is used—say at any pressure—imagine the steam admitted until the piston reaches half-stroke, the boiler communication closed, and the steam allowed to expand through the rest of the stroke, the exhaust opened, and the piston returned—then upon the steam coming in on the next stroke, we should expect to find the internal surfaces in the same condition as they were at first. But experiments and all experience have shown us, that in the operations which have gone on during the first stroke, the internal surfaces have become chilled to a certain extent, and that a considerable portion of the steam entering is condensed by them, and converted into water.

This fact has been shown by Isherwood in his experiments, made with great care and expense, and the result has been found to be nearly 39 per cent loss, at half cut off—and the best engineers now estimate that about one-third of the fuel is wasted in this way. The only known remedy for the prevention of cylinder condensation is the proper use of superheated steam, by which one-third of eighty-five millions would be about twenty-seven millions of tons of coal per annum, amounting to nearly $100,000,000 per annum.

Let us give an example of the manner in which superheated steam acts in the cylinder. First, it follows a different law from saturated steam; it is governed by Marrotte's law of gases and air. You can, by the addition of 480° of heat to the steam in a separate vessel, or superheater, double its volume and also its pressure; if it were attempted to raise steam in a boiler to 692°, it would have to be strong enough to stand a pressure of 2,500 lb. to the square inch. Superheated steam is the safest and most economical method of using steam.

One pound of water heated in a boiler to 212° is, by the addition of 966 units of heat, converted into 1,720 volumes of steam at atmosphere pressure. The 1,720 volumes may be taken as the measure of the available mechanical force—the 966 units of heat are worth 1,720 volumes of steam. Now, if these 1,720 volumes of steam at 212° be raised 480° higher, or to 692°, you will have 3,440 volumes of steam at *double the pressure*, or 15 lb. to the square inch. The 480° used upon the steam has given you the same quantity as 966 units used upon the water.

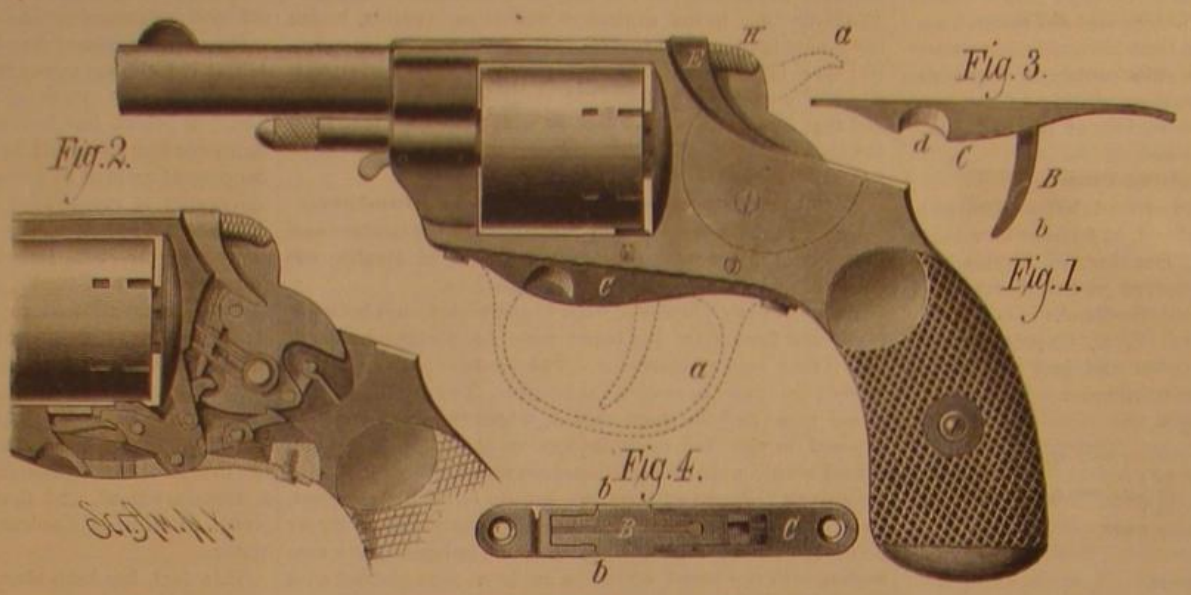
How much heat is required to raise 1 lb. of steam 480°? The specific heat of water is 1,000—the specific heat of steam is 0·475, or a unit of heat will raise 1 lb. of water 1°—and 1 lb. of steam 2°. But in our case, suppose the steam was raised 480°, and now it is evident at a cost of 240 units of heat, the 240 units of heat used in superheating have done the work of 966 units used upon water; heat goes *four times further* on steam than it does on water—if the heat costs the same as when used upon water, the clear gain is 25 per cent.

The primary causes of cylinder condensation are external and internal radiation of the metallic surface—conversion of heat units into work—and conversion of heat into work done during the first rush of the steam from the cylinder after the opening of the exhaust. A further economic effect is produced by the great increase of volume of steam caused by the addition of superheat. If 400° is required in the cylinder (which it is perfectly safe to use) at one-half cut off, it would be necessary to have your steam in the superheater at about 596°, so that having it expanded down to 400° at the half cut off, you not only suppress entirely cylinder condensation, with its enormous save, but you increase your power about one-sixth.

The *modus operandi* of superheated steam in the cylinder is this: All superheat is given off *before condensation commences*; the moment the superheated steam enters the cylinder the superheat is absorbed by the metallic surfaces. The piston is now propelled, with steam less the superheat, to the point of cut off. When a portion of the steam is converted into work, and the balance expanded into the remaining half of the cylinder, now the superheat absorbed by the metallic surfaces (upon the principle that all things in nature seek their equilibrium) gives out its superheat to the devitalized steam, revivifies it to a condition to enable it to perform the other half stroke, and the exhaust is then discharged at saturation. Steam used in this way makes the modern steam engine the most perfect in the world. It enables the maker to exhibit it as a real steam engine, and not one working half water.—*American Railroad Journal.*

SAFETY SELF-COCKING ARMS.

Portable firearms, to perfectly meet all requirements, should combine three essential elements—compactness, rapidity of action, and safety in handling. The only advantage of revolvers, as compared with repeating rifles, is their smaller bulk and weight, as they are inferior in rapidity of firing, and still more so in accuracy and penetrating power. Among revolvers, again, the ordinary hand-cocking revolver is superior in safety and compactness to the self-cocker, but greatly inferior to it in rapidity of firing. Self-cockers, as usually made, are clumsy and particularly dangerous to handle, and this has overweighed the advantages they present for rapid firing. A compact and safe self-cocker which avoids these difficulties is shown in the engraving.



SAFETY SELF-COCKING REVOLVER.

The usual bulky open guard and the fixed projecting trigger are replaced by a low-closed guard and a folding trigger, shown in Figs. 1 and 2. The dotted lines, *a a*, show the position of the parts dispensed with, and show how much is gained in compactness by this improvement. The folding trigger, B, Figs. 2 and 4, is readily projected from the guard, C, by pressure on the lugs, *b b*, placed on either or both sides of the trigger, and assumes the usual position of the trigger shown by dotted lines in Fig. 1. The lugs, *b b*, on the trigger, and the slots, *d d*, in the guard to receive them, are placed so that the trigger cannot be folded back into the guard when the hammer is either at full cock or entirely down, but only when it is at the safety notch, or at half-cock. This impossibility of securing the trigger in the guard unless the hammer is at half-cock, is a very ingenious and effective means of preventing the many accidents which result from arms carelessly carried with the hammer in a dangerous position. The very simple device of slitting the trigger longitudinally in the manner shown in Fig. 3, transforms the trigger itself into a spring, and retains it in the guard by friction when folded up.

The face of the hammer, when at half-cock, is protected by a shield or hood, E, Fig. 1, and the usual thumb-piece being dispensed with, there are no projecting parts susceptible of catching and causing an accidental discharge of the arm. The roughened top, F, of the rounded hammer, is found to practically answer the same purpose as the thumb-piece, in bringing the hammer to full-cock by hand, as soon as the hammer is brought beyond half-cock by the trigger. Altogether, a self-cocking revolver of this model is lighter, more compact, and safer than the usual revolver, and infinitely more so than the usual self-cockers. The current form of self-cocking revolvers can readily be modified to this system, which can also be adapted to other kinds of firearms, and especially to the now popular styles of so-called "hammerless" guns.

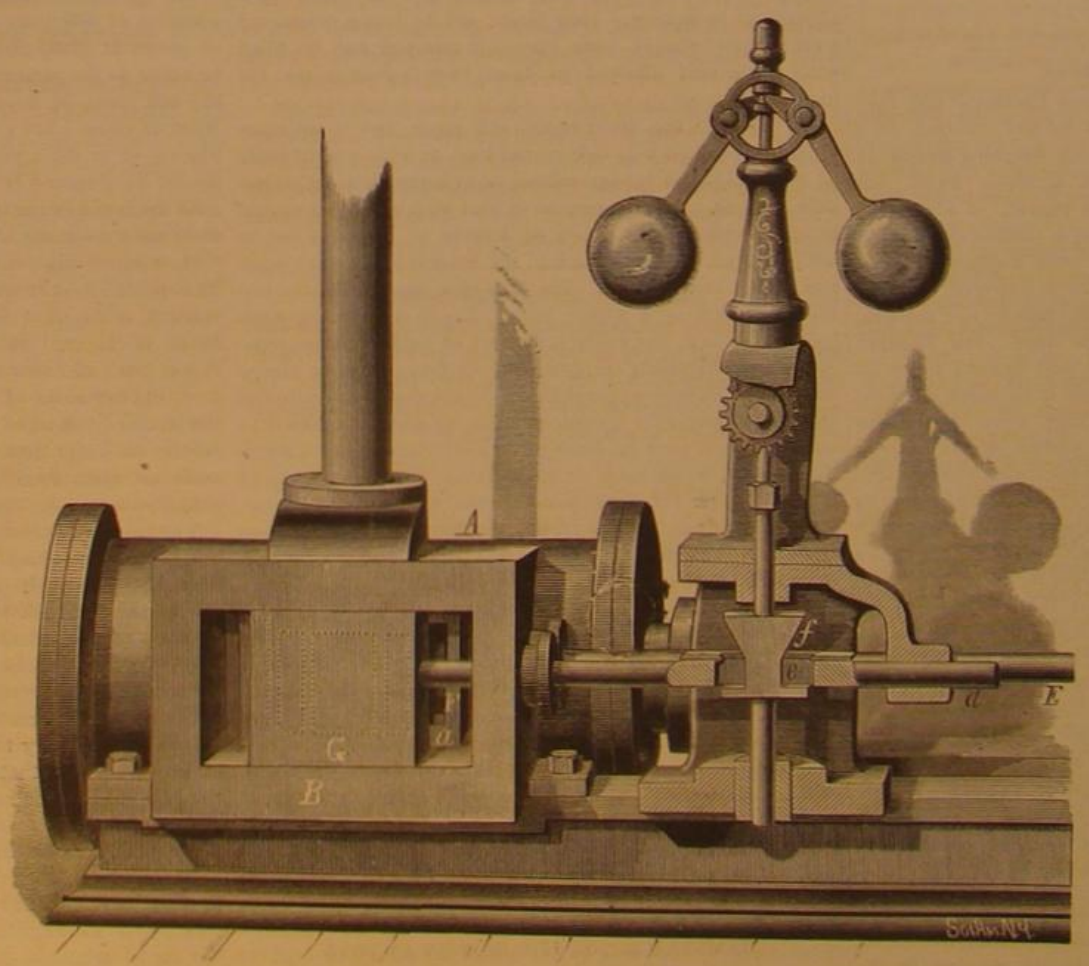
For further information address the patentee, Mr. J. N. Proeschel, at Milwaukee, Wis.

NEW ENGINE CUT-OFF.

This invention relates to a variable cut-off for the ordinary slide valve steam engines, which is rendered automatic by connection with the governor, the combination being very simple and effective.

In the engraving, A represents the cylinder, and B valve chest of an ordinary steam engine. The eccentric rod, E, is connected to a gridiron valve, F, having steam ports, *a b*, and an exhaust port, C, working in conjunction with the steam ports and exhaust ports of the cylinder, as usual. On the back of the valve, F, is a plate, G, forming the cut-off valve, this plate or valve being held firmly against the back of the valve, F, by the pressure of steam, and being dependent for its movement upon this frictional contact with the valve, F.

A stem, *d*, projects from the plate or valve, G, through a stuffing box in the valve chest, and this stem is provided with a yoke, *e*, which embraces a wedge-shaped block controlled by the governor. The wedge, *f*, thus acts as a stop to limit the extent of movement of the cut-off plate or valve, G, the movement being contracted as the wedge is depressed, and an increased movement being permitted as the wedge is raised, the variations in the movement of the plate, G, are caused to regulate the cutting off of the steam to the cylinder. The wedge exerts no control, practically, over the movement of the valve, G, the latter moving with the valve, F, throughout the entire throw of the latter, so there is no resistance of the entrance of steam into the cylinder from the beginning almost to the end of the stroke, hence there is no labor on the governor except to raise and depress the wedge; the wedge shortens the throw of the valve, G, and thereby cutting off the steam proportionably with its position.



IMPROVED ENGINE CUT-OFF.

Further description being unnecessary, except that if the governor should stop from any cause, such as the breaking of the belt, the wedge-shape block has an enlarged portion, so that its position in that case will be inside of the yoke on the valve steam, *d*, and shorten the stroke to limit the speed of engine. Further information can be had by addressing Orr, Hess & Morgan, 1219 Callowhill street, Philadelphia.

A Mediæval Guillotine.

The Chapel Bridge, at Lucerne, contains a mediæval painting representing the persecutions of the Helvetian Christians under the pagan Emperors of Rome. On the right side of the picture a number of Christians are being hurled into a river, perhaps the Reuss. On the left side a very evident guillotine is erected, one Christian lies with his head on the block, and the huge iron is just about to be let drop upon him, while a number of headless bodies lie around with the heads close beside them. It is commonly believed that this decapitating machine was the invention of Dr. Guillotin, a French physician, and member of the National Assembly of 1789. The Lucerne painting was made at a much earlier date.

Engineering at the Washington Monument.

The Washington monument is too near to be ever regarded by Washington people as anything out of the ordinary run of things. Few people here ever stop to think what a feat of engineering has been undertaken in the construction of this monument. "There is nowhere in the world such mechanical appliances as we have in the monument," said Colonel Casey to a *Star* man. "The last course of stone laid weighed 170 tons. Now this 170 tons was raised vertically a distance of 245 feet, and the course was laid in fifteen hours. In other words, two feet of the monument was built in that time. You haven't any idea of the amount of stone and the amount of work required to build the monument. The stone we have laid since the work was resumed, if taken down and spread out, would cover the entire monument lot. At a distance the monument looks small; the yardarms on the derricks on top look like broom splints; but when one gets nearer them and sees how large they are, how wide the structure is, he gets some notion of the work."

If the monument was being constructed in France, or some other European country, the name of the engineer would already be famous, and when his work was finished, if it was approved, he would receive a fortune as his reward. It is doubtful whether the engineer connected with the Washington Monument will ever have any special recognition by the government. He will never receive any pecuniary recognition. An old engineer officer, speaking of this matter, said: "If Colonel Casey was not in the army, and had charge of one of the several works for which he is now responsible, his salary would be $10,000 or $15,000 a year; as it is now, he draws $3,000 a year. The government pays too high figures for services rendered in inferior places, and much too little for professional services. —*Washington Star.*

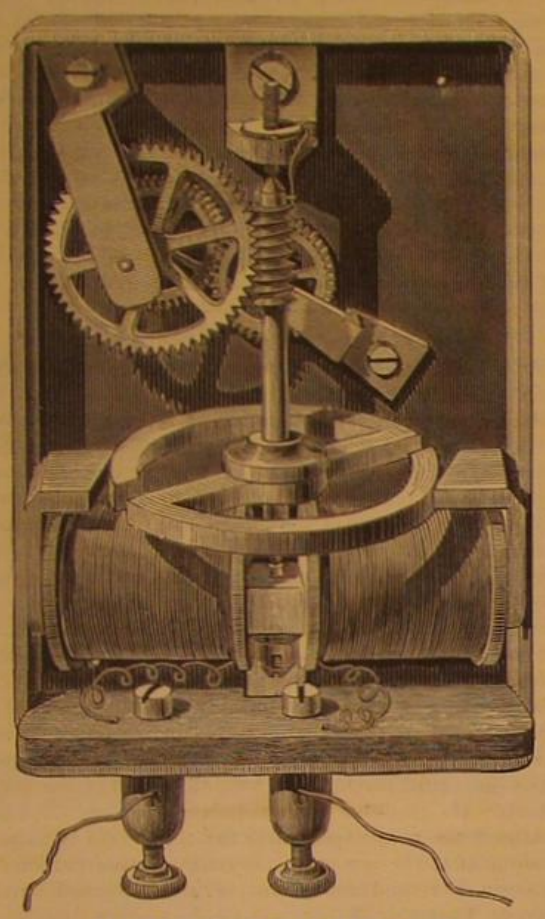
The Severn Tunnel.

After some rather formidable difficulties, the two main headings of the Severn tunnel, in course of construction for the Great Western Railway Company, were united on the night of September 26 last, and a clear passage thus made under the bed of the river. The difficulties have been brought about chiefly by the flooding of the headings, which occurred now nearly two years ago. Water from springs in the surrounding hills on the Monmouthshire side drove in a large mass of the somewhat fractured pennant sandstone through which the tunnel passes, and so filled the workings on that side. The heading on the Gloucester side also filled, and the work was stopped, as described in our impression for the 24th October, 1879. There was at that time only 120 yards of the heading remaining to be driven. Very powerful pumping machinery was then put to work under the contractor, Mr. A. T. Walker, to whom the completion of the tunnel was let, and the work of driving the heading was resumed after several months' delay. The meeting of the two headings shows but three inches of divergence, and considering that the distance driven has been upward of two miles, that the headings are 7 feet high, with a width of 7 feet, started from a base of only 15 feet, the work, it will be seen, reflects great credit on the skill and attention of the engineering staff. It should be mentioned that the heading from the Monmouthshire side was driven 11,000 feet from the bottom of a shaft 180 feet deep. This was a very wet shaft, and there was very great difficulty in seeing down or getting plumb lines steady on account of vibration caused by the pumps. The Great Western Railway Company constructed the heading on the Monmouthshire side by its own officers, and up to the time of the stoppage on the Gloucestershire side, Mr. Oliver Norris, then contractor, had driven 1,680 feet, this heading being driven on a decline of one foot in a hundred. The remaining portion was carried out by Mr. A.

T. Walker, the present contractor. The accuracy with which the lines were taken and the engineering work carried through thus far is, of course, due to the engineering staff—Mr. Charles Richardson, assisted by Mr. A. W. Gooch and Mr. John J. Geach. The land portions of the work remain to be completed, and will, no doubt, occupy a considerable time. The tunnel will also have to be widened to a width of thirty feet, with a proportional height. The completion of the headings is, says the *Engineer*, a fact of great interest from an engineering and geological point of view, and gives every hope that the tunnel will now be completed by Mr. Walker, at a speed which will satisfy even the railway company.

ELECTRIC CLOCK-DIAL MECHANISM.

The construction of a perfect electric clock involves several difficult problems, and it is this which explains in part the existence of a large number of electric clocks varying in



ELECTRIC CLOCK-DIAL MECHANISM.

efficiency according to the attention paid to the fundamental principles which should control their construction.

Electricity actually plays three very distinct characters in the electrical clock, and the Paris Electrical Exposition presents numerous examples of this:

1. Electricity is made use of as a motive power, to swing a pendulum and replace the springs or weights of an ordinary clock.

2. Electricity is employed for transmission. A central clock sends an electric current every second, half minute, or minute, to one or more dials placed at a distance, which causes the hands to advance respectively a second, a half minute, or a minute.

3. Electricity is employed to regulate clocks and dials propelled by ordinary weights and springs, and adjusts the hands every hour, every six hours, or every twenty-four hours. It is this system of synchronism which has been adopted by the city of Paris for the public clocks.

We do not wish to discuss here the respective advantages of the two systems of distribution of time in a city by electric transmission or by electric adjustment effected at fixed intervals. The electric distribution of time has some special advantages which are not possessed by the system of electrical adjustment, and the disadvantages disappear in proportion as the apparatus is perfected and simplified. The pneumatic clock established in Paris two years ago has a transmitter operated by compressed air.

The engraving represents a simple electrical dial mechanism which exactly fulfills the requirements, working surely each minute under the action of the current sent by the central distributing clock.

All of the earlier forms of electrical dial apparatus are operated by an oscillating armature, moved by an electro-magnet and retracted by an antagonistic spring, or two electro-magnets acting upon a polarized armature. The movement of the armature is transmitted to the gearing by the levers and pawls, which must be very perfectly adjusted, as they cease to act if there is a little play, wear, or oxidation. In order to give a slight movement to the armature it is necessary to lengthen the lever immoderately.

All of these inconveniences are avoided in the very simple apparatus of M. Thomas, the mechanism of which is represented in the engraving. It is composed of a horizontal electro-magnet, the poles carrying two armatures, between which is placed a polarized armature in the form of an S, fixed upon a vertical axis. This axis carries an endless screw, which operates the minute hand and gearing. The transmitting clock sends into the electro-magnet alternate positive and negative currents at every half minute. The current sent is such that it develops in the poles of the electro-magnet alternate positive and negative polarity, so that the polarized S-shaped armature is first attracted and then repelled, causing a half revolution of the S-shaped armature for every electrical impulse. The current should continue from two to three seconds, in order that the polarized armature may be maintained in position. The endless screw carries along the gearing and causes the hands to advance each time.

In consequence of its inertia the polarized S shaped armature tends to pass beyond its half revolution, and the speed acquired toward the end of the half revolution is checked by means of a spring against which a pin carried by the vertical spindle strikes at each half revolution.

This simple and ingenious apparatus requires no regulation. The rotation will be produced, whatever may be the distance from the extremities of the polarized armature to the electro magnet, and this distance may vary from one to two millimeters.

The power of the apparatus is determined by the dimensions of the S shaped polarized armature of the electro-magnet, and by the size and length of the wire which surrounds them.

By using a high tension current of electricity a large number of these electrical dial movements may be placed upon the same circuit and made to operate dials of two meters in diameter.

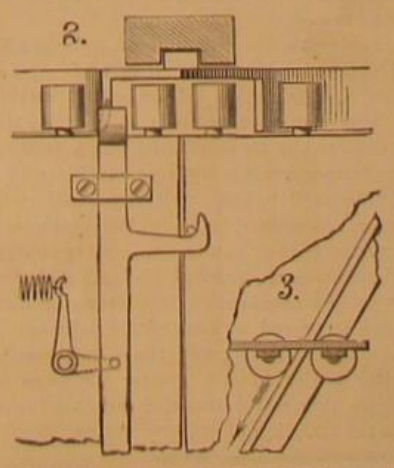
At the Exposition of Brussels, in 1880, where the electric dial mechanism of M. Thomas was in operation for the first time, he had in the same circuit a large dial of 1·80 meters in diameter and eighteen other smaller dials of 0·50 meter and 0·40 meter. They worked perfectly, excepting the five or six interruptions proceeding from the stopping of the transmitting clock caused by the moving of the platform on which the clock was placed.—*La Nature.*

Fire Risks and Tall Buildings.

We have frequently called attention to the fact that modern architecture was the greatest peril with which our large cities is threatened. During the present year, thousands of new buildings are being erected in this city, and of these a large number are tall buildings, seven, eight, and nine stories high, insecurely built from the foundation to the mansard roof, having granite foundations to support cast iron columns, which in turn support iron girders, upon which the floors are laid. Such a building is dangerous for a fireman to enter when a fire is raging within, as the granite foundation is liable to melt away under intense heat, and the iron columns and girders to twist and break, precipitating the floors above, with all their contents, into the basement. Put on top of such a building a mansard roof made of pine, and introduce an elevator shaft to carry the flames almost instantly from one floor to another, and you have a modern death trap that could scarcely be improved upon as a fire hazard, threatening the surrounding buildings and the lives of whoever may venture near it. In the lower part of the city there is one building whose roof is 185 feet above the sidewalk—away out of the city limits—and near by are many others nearly as tall. A fire in that roof would be wholly inaccessible to the firemen, while a high wind would scatter the blazing brands upon the roofs of lower buildings for many blocks.—*Fireman's Journal.*

IMPROVED HATCHWAY DOORS.

The accidents and dangers chargeable to open hatchways are too familiar to our readers to need recital, and it must be acknowledged that the various trap doors, gates, and other appliances in common use for rendering hatchways safe, are deficient in one way or another



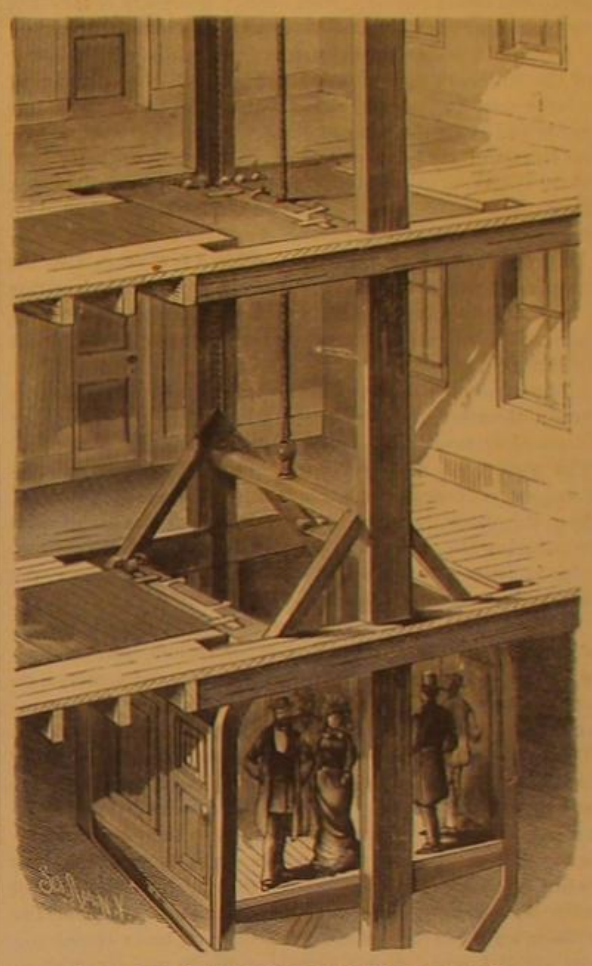
CHAMBERS' AUTOMATIC HATCHWAY DOOR.

Section showing angle irons, rollers, and fastener.

Our engravings represent improved automatic hatchway doors, which are opened and closed by the elevator car as it passes through the floor on which the doors are placed.

The doors are made of heavy boiler iron or of wood, and are placed either under or on the floor, or under the ceiling, as choice or convenience may require, and are so constructed as to easily move or slide horizontally upon rollers or tram-rails. Their operation is positive and automatic. The apparatus is simple, and can readily be applied to any platform elevator already in use. It consists in the attachment of angular irons about the cab or platform so as to form cam braces above and below it, as is indicated in the engraving; and as the platform passes up and down these angular irons run between two wheels or rollers attached to the doors, causing the doors to open as the platform approaches them and close as the platform passes through, making a complete covering for the hatchway—preventing any one from falling through—cutting off draught in case of fire, and when opening conveying safely off any one who may inadvertently stand in the way. Open hatchways become flues, conveying fire and smoke from floor to floor, with uncontrollable rapidity. The improvement shown in the engraving will confine to the floor where the fire originated.

In storerooms requiring heating these doors are found very efficient in preventing the escape of heat from one floor to another. The improvement also prevents the floods of dust and dirt which are constantly pouring through open hatchways.



CHAMBERS' AUTOMATIC HATCHWAY DOOR.

For further information address the Chambers Elevator Company, 145 Central avenue, Cincinnati, Ohio.

Electrical Measures.

At the late Electrical Congress in Paris a committee on electrical units made the following recommendations, which were unanimously adopted: 1. The fundamental units be the centimeter, gramme, and second (C., G., S.). 2. The practical units, ohm and volt, to retain their present definitions. 3. The unit of resistance, or ohm, to be represented by a column of mercury of a square millimeter section at the temperature zero Centigrade. 4. An international commission, to be charged with the duty of determining by new experiments, for practical purposes, the length of the column of mercury, of a square millimeter section at zero Centigrade, which represents the value of the ohm. 5. The name ampère to be given to the current produced by a volt in an ohm. 6. The name coulomb to be the name given to the quantity of electricity defined by the condition that an ampère gives one coulomb per second. 7. The name farad to be given to the capacity defined by the condition that a coulomb in a farad gives a volt. Until something better is discovered than the English candle, the French *Carcel bec*, and the German standard for the measurement of the electric light, preference will be given to the Carcel lamp.

A Can Soldering Machine.

Mr. Henry R. Robbins, of Baltimore, Md., has patented an improved machine for soldering the heads of tin cans to the bodies thereof. In this machine the cylindrical body of the can, having its heads applied, is held in horizontal position, and rotated by vertically moving supports and rotary holders or clamps, while the molten solder is discharged upon the joints of the can heads from an upper receptacle by hollow pistons or chargers which are controlled by the operator. A liquid flux is automatically supplied to the joint and soldering irons brought in contact with the can by the same motion which brings the latter up against the discharge tubes of the molten solder receptacle containing the chargers. A single rotation of the can holders will suffice to secure a firm soldering of the heads to the body of the can, which may then be removed by sliding one of the rotary can holders away from its end of the can. The machine is very ingenious and complete in all its details.

Manufacture of Paper Pulp from Wood.

The invention of wood pulp has revolutionized paper making and paper prices. It has brought good books, good newspapers, and writing paper within the means of thousands of the common people who could never have afforded such luxuries had rags remained the only available material for papers of good quality. Pulp is made from several varieties of wood, and by both mechanical and chemical processes. A chemical pulp from sound poplar wood has no superior.

In the busy manufacturing town of Manayunk, Pa., a few miles up the Schuylkill Valley from Philadelphia, the operations of wood pulp making may be seen on a large scale, in the extensive works of the American Wood Paper Company, where twelve thousand cords of poplar from the forests of Virginia are annually converted into paper fiber. A description of the manufacture as here carried on will afford a fairly representative idea of the methods of this industry at its best development; while certain accessory details will furnish some indication of its commercial importance.

The mills, which are substantially but plainly built—some of the buildings one and some two stories high—spread over a large area in the outskirts of the village. In the ample yards and along the bank of the canal are always piled several thousand cords of wood. This is cut to ordinary cord wood length, along the York and James and Rappahannock rivers, and having been cleanly barked is cheaply floated up the coast and then up the Delaware River to its destination. Yet so great has been the drain, within a few years, that the supply of first class poplar is already approaching exhaustion in the localities named, and before long the army of choppers will have to shoulder their axes and move farther down in Dixie.

The wood once at the mills the operations of pulp making group themselves into three classes. There is first the mechanical process of cutting the sticks into small chips. The conversion of these into pulp constitutes a second distinct set of operations, while a third, also entirely distinct from the others, includes the preparation of the alkali used in reducing the chips—and the reclamation, for further use, of soda from the liquor that drains off from the pulp. We will look at each in turn.

The chipping is a simple operation, soon done with. A stick is placed in a sloping slide or trough, and its own weight holds its lower end firmly against a set of powerful revolving knives, which rapidly cut it at an angle of 45 degrees, across the grain, into chips five-eighths of an inch thick. These fall into the basement, where boys shovel them into cars similar to those seen for wheeling ore in blast furnaces, and they are taken up by elevator to the second story, to be thrown into the digesters. At this point the chemical processes begin. The digesters are upright boilers, the tops being on a level with the second floor. Underneath, level with the ground, are furnaces, while above and behind the boilers, on the second floor, are large iron tanks containing the alkali liquor—strong caustic soda—in which the chips are to be boiled. Each tank has an outlet pipe and stop-cock for discharging its contents into the boiler beneath. At the works we are now describing there are thirteen of these digesters, with their corresponding furnaces and tanks. When a digester is to be filled the cover closing the top is removed and the stop-cock opened, allowing alkali to run and mix thoroughly with the chips which are shoveled in at the same time. When full to the top the packing cover is replaced and secured by a strong bar held firmly in place by a heavy nut screwed down tight. The liquor is soon in vigorous ebullition, and the steam pressure is allowed to reach 100 pounds. In this manner the chips are cooked until reduced to a pulp as soft as the most delicate jelly, every trace of resemblance to its original condition having disappeared.

The contents of the boilers are now blown off into strong iron tanks capable of withstanding the steam pressure in the boilers. From the tanks the pulp and liquor are drawn into what are known as pulp cars. These are simply large vats, with perforated bottoms, and mounted on small wheels, each vat having a capacity equal to that of its adjoining tank. The liquor drains off into tanks prepared to receive it, and clear water is then run through the mass of pulp until all traces of soda are washed out, for every particle of that costly chemical is worth reclaiming for further use. The pulp cars are then run out upon turn-tables, from which they are run down a track to the mixer to be thoroughly mixed with clear water, after which it is pumped into the large pulp chest. From the latter it runs into the two pulp dressers, where any bits of undigested wood are intercepted by screen plates. Leaving the dressers in the form of large sheets, it is immediately torn up and thrown into the bleaching engines, where, through the action of chloride of lime, it is freed from all coloring impurities and left creamy white.

The operations are now nearly complete. From the bleaching engines the pulp is run into the drainers—large vats in the basement—where the chloride of lime is thoroughly washed out. Thrown out from these, the pulp is once more mixed up with clear water, and after passing through a second set of pulp dressers, is run through the 84-inch cylinder machine and over the nineteen driers, which convert it into a strong thick sheet, much resembling blotting-paper, except that the surface is harder and smoother. From the driers it is wound on a long reel, and from the latter it passes between knives that divide it longitudinally into three strips, each of which is wound on a cylinder into a roll of about 118 pounds weight. Nothing remains but to wrap the rolls suitably in packing paper and they are ready for shipment.

The interesting operations of reclaiming soda and making caustic soda remain to be looked at. We noticed that when the pulp, having been reduced in the digesters, was drawn off into the pulp cars, the liquor was drained off and clear water run through the pulp to wash out all traces of soda. This liquor is the original caustic soda, mixed with coloring matters and other chemicals in small proportions, boiled out of the chips. The successive washings, of course, contain the same ingredients, only more and more diluted. All these drainings pass into tanks from which they are pumped to the evaporating house, a large dingy structure across the yard from the pulp making buildings. Here are four furnaces, each fitted with a large evaporating pan so adjusted that the flames pass over the pan on their way to the chimney. The hot gases are still further utilized before being allowed to escape by being passed over another set of pans placed high up toward the roof. The liquor is pumped into these upper pans first, where some of the water is evaporated. It is then run down into the furnace pans, where the balance of the water is evaporated and all vegetable fiber burned out, leaving nothing but black soda ash, which is hauled out and thrown on the ground to cool. Care must be taken not to burn the soda.

A large storehouse stands near by, to which this black ash is taken, and where are also kept white soda ash and lime. Passing from this we enter the alkali house. On the upper floor are ten tanks, into which are put water, black ash, lime, and a small percentage of white ash. Steam is applied and the mixture thoroughly boiled until converted into caustic soda, which is simply the hydrate of soda, or soda held in solution in water. It is then run off into vats and left to stand over night to clarify. A sediment sinks to the bottom composed of lime and the coloring matters of the black ash. The clear liquor is drawn off and is ready for use in the digesters. The sediment is thrown into other vats and water run on it to take up any soda remaining, a process which may be repeated several times. The sediment or waste finally thrown out is of no value.

The capacity of these works is eighteen to twenty tons of fine pulp every twenty-four hours. The product is highly esteemed wherever it has found its way for its superior quality. Large quantities are lately being shipped to France. The works were originally run by water power, but the frequent recurrence of low water compelling a shut-down of eleven or twelve hours out of every twenty-four, has led to the introduction of steam. The pulp department is now driven by two fire engines of 250 and 125 horse power respectively, and the water which still turns the machinery of the alkali department will soon give way to its more reliable rival. Twenty-five thousand tons of coal are already consumed every year in the furnaces, an amount which will, of course, be greatly increased now that it is also used for motive power.—*Paper World.*

Industrial Mortality.

An English statistician has lately brought out the following fact, which, it is claimed, is a discovery and a fit subject of legislation. It appears that 107,000 men, women, and children have lost their lives or been injured in English mines and factories, on railways, and by boiler accidents during the four years preceding 1877, and on this basis, it is estimated that half a million workmen will lose their lives in ten years—300,000 in mines, 70,000 on railways, and 130,000 in factories.

Another writer sets the figures at a full million, or 100,000 persons per annum in England alone, killed from causes in connection with the industrial occupations in which they are engaged. As much as six-tenths are ascribed to mining accidents. This aggregate is sufficiently appalling, and ought to be inquired into in this country as well as in England, but it is difficult to prescribe efficient legislative measures to meet the case.

It is probable that the diffusion of technical knowledge among all classes of laborers and artisans, and especially the foremen and managers of industrial establishments, would do more than laws, not only to decrease the number of violent deaths, but to ameliorate the sanitary condition of all establishments where tools or machines of any kind are used. The well lighted, well aired, and roomy workshop or factory, moreover, promotes the production of more and better products than can be expected from dark, damp, and dingy cellars and crowded, ill-ventilated, dirty shops in densely packed neighborhoods. Even the dismal mine may be much improved by the electric light and more efficient ventilating appliances, and the natural result is more safety, better health, and a greater yield, so that once understood no thoughtful manager will need to be driven by law into the adoption of sanitary means.

Steel Breastplate.

Some interesting experiments have been lately carried out in Leipsic with a cuirass made of a newly invented preparation of steel. The metal of the cuirass is only about three-fiftieths of an inch thick, and is lined inside with a thin layer of wool. The cuirass itself is 14 inches wide and 10 inches high, being intended only to protect the heart and lungs, and weighs 2¼ pounds. Eleven rounds were fired at it at a distance of 175 yards from a Martini breech-loading rifle, and of eight bullets which struck the cuirass only two pierced the metal, while even these were completely flattened and remained in the woolen lining, so that a man wearing the cuirass would have been uninjured.

ENGINEERING INVENTIONS.

An improvement in railway air brakes has been patented by Mr. Clarence L. Lorraine, of Oronoco, Minn. The invention consists in a novel arrangement of hanging bars, connecting rods attached to brake beams, and an expansible and contractible air chamber.

Mr. Dyson D. Wass, of San Francisco, Cal., has patented an improved device for removing air and grease from feed water. The invention consists in a chamber into which the pipe from the feed pump conducts the feed water, this water being drawn from this chamber below the surface, so that the oil and grease which rise to the surface of the water cannot leave the chamber with the water. As the air forced into this closed chamber is compressed therein and forces the level of the water downward, a float valve is provided, which opens an air cock to allow the air to escape as soon as the water level drops to a certain extent.

An improved steam engine governor has been patented by Mr. John W. Peck, of Evansville, Ind. This invention relates to devices which are more particularly intended for use in connection with what is known as the "Corliss engine," the object being to provide means for quickly stopping the engine in case of accident. The improvement consists in the combination, with the cut-off valve gear, of one or more independent stop cams, located on the same moving part with the cut-off cams, and a detachable connection with the governor, which transmits the normal action of the governor to the cut-off cams, but which at will may be broken to allow the stop cam to throw the cut-off gear out of action and stop the induction of steam.

Cheap Antiseptic and Disinfectant.

Prof. Beilstein has made comparative experiments with disinfectants, to determine their relative value as such. He arrives at the conclusion that aluminum sulphate is an effective and at the same time the cheapest substance arresting putrefaction. If sufficient time is given for its action (two to three days), a four per cent solution will effect more than a fifteen per cent solution of ferrous sulphate, thereby counterbalancing any difference in price in favor of the latter. Besides, a very crude article might be manufactured from clay and sulphuric acid, which would be very cheap indeed. A four per cent solution of aluminum sulphate will kill all infusorial life, no matter how tenacious. However, this substance has no power of destroying putrid odors, and for this carbolic acid seems to be the only available article. The author inclines to the belief that this disinfectant does not merely supplant foul odors by its own, but that the phenol enters into actual combination with the skatol of the fæcal effluvia. He therefore recommends aluminum sulphate, combined with a little phenol, as the most effectual as well as economical for rendering decaying organic substances both odorless and innocuous.—*Pharm. Centralh. from Deutsche Viertelj.*

Braga Beer.

This is a kind of beer brewed in Russia. C. O. Cech, the editor of the *Russian Brewers' Record*, gives some interesting particulars of the primitive system of brewing adopted in preparing it. In order to obtain 25 wedros (about 2 barrels) of beer, 1 sack of corn, 40 lb. of malt, and 3 lb. of cultivated, or 5 lb. of wild hops, and 40 wedros (about 3 barrels) of water are taken. The whole of the corn and malt is placed in a wooden vat and treated with 30 wedros (about 2½ barrels) of boiling water; in the meantime the hops are boiled in a copper. In a second vat a layer of straw is spread over the bottom, the latter being provided with a small opening into which a long rod is fixed, which is used as a stop valve. The steamed hops are then brought into this vat, and the sweet wort and boiling water added. The rod is then drawn up, and the hopped wort filters through the straw into a tub. It is again warmed, then brought in contact with the hops and filtered, and this operation is repeated till a clear liquid of aromatic smell has been obtained. One liter (about 1 quart) of yeast diluted with 4 wedros (about 10 gallons) of warm water is now added to the wort, and the whole allowed to ferment for two hours. The beer is then transferred to casks and left to ferment in a cool place, the yeast escaping through the vent hole. After two or three days the vent peg is fastened firmly into the cask, and the beer is ready for use shortly after this time, but it is considered preferable to bury the casks in hay for a short interval. By this treatment the quality and brightness of the beer are considerably improved.

A Prolific Ewe.

Mr. A. Chartraud, of Matanzas, Cuba, reports, in a communication to us dated September 27, the following remarkable behavior of one of his ewes. On the 3d of January last this ewe gave birth to a lamb, which appeared to be strong and healthy, but died in about a fortnight. The ewe appeared to be still with lamb. On the 8th of February she dropped another lamb, which lived and throve. On the 13th of March she dropped two lambs, both living. In September she was again with lamb, and on the 10th she dropped a strong and healthy one. On the 26th she dropped another; and when our correspondent wrote, the next day, she was apparently still "full."

Mr. Chartraud adds: "I have visited numbers of sheep owners, but no one has ever witnessed such a departure from the natural order of things. This makes the sixth lamb since the beginning of the year. I have heard of a foal of four lambs, but all in the same day or period of birth."

THE CONDOR.

The condor is a native of the mountain chain of the Andes, and is one of the largest of the birds of prey. The average expanse of the condor's wings is from eight to nine feet, and the length of the body from the point of the beak to the extremity of the tail three feet and five or six inches.

The color of the condor is a grayish black; the wings are marked with white, and there is a collar of downy white feathers about the neck. The crest of the male is quite large. The internal structure of the condor presents some curious features; the "gizzard" is provided with longitudinal rows of horny spikes, which are supposed to assist the bird in the rapid digestion of its food.

These birds often attack cows, bulls, and deer, and as their assaults are chiefly directed upon the eyes, they blind their victims, and they soon fall by the blows which are inflicted upon them by the beaks of the birds.

The condor is very strong, and even when wounded a powerful man is no match for one of these creatures.

The Indians have a great dislike to these birds, and if they capture one of them alive they torture it very cruelly. Their mode of capture is as follows: They kill an animal and expose the body in the open air. The condors soon assemble in large numbers and feast upon the flesh. As soon as they are gorged to the full the Indians dash in among them and capture them with their lassos. When they feel the noose around their necks they endeavor to reject the meal which they have swallowed, but are made captives before they are able to rid themselves of the food.

The flight of these birds is grand and beautiful; they seem to fly by moving the head and neck rather than the wings.

Although there have been condors in the Zoological Gardens at Dresden since 1874, it is only recently that anything has been found out in regard to the length of the brooding season, their habits at the time, their manner of feeding their young, etc.

Very little has been known of the habits of these birds until lately, as they live at a height of from 10,000 to 15,000 feet, and only come down to the lower points in search of prey. The Indians assert that the eggs are laid upon the bare rock, the bird making no nest whatever.

The condors in Dresden commenced laying in April, 1877, and, after that, laid from two to three eggs yearly in April or May, but unfortunately they crush their eggs immediately, or after playing with them several days. Last year a nest of dried branches, feathers, and wool was made in the top of the cage, about two meters from the ground, and it was thought that the birds would avail themselves of it. Loose material for nest-building was also put in the cage, but the female laid her eggs in the sand as before, and both the eggs were soon destroyed. The same thing happened this year in the middle of April. Shortly after the birds were removed into the large summer quarters of the birds of prey, and the female laid an egg on the 9th of May, in a dark corner of the cage. The next day the male commenced to brood. All the materials for a nest that the keeper laid under and about the egg were rejected and scratched away, and the brooding went on upon the gravel bottom of the cage. The male devoted himself to the brooding the greater part of the time, the indolent female only setting upon the egg about a third of the time.

On the seventh of July, after nearly eight weeks, the keeper announced that he had discovered life in the egg, and on the same day a rent was perceived in the shell. The next day the bird had almost escaped from the shell, only the head and neck remaining in, and on the following day the bird was entirely freed. Since then the old birds have been very busily employed in giving the little one the necessary warmth, and have manifested equal anxiety in feeding it with horse flesh and small pieces of cat and dog flesh. The little fellow, with its grayish feathers, looks something like a young owl. Its head and neck are quite black. If any one approaches, it commences already to utter angry cries, and the old birds are so ugly that the keeper can only enter the cage armed. The brooding continued for eight weeks less one day. Cassel says, in his "Natural History," that a condor's egg was hatched in six weeks and two days by a hen. This may be on account of the nest which the hen had.

The young bird, on the first day, measured ten centimeters in length, and on the twentieth day twenty-eight centimeters. The condors are fond of bathing, and often sit upon their eggs with their wet feathers.

New Zealand Fungus Trade.

During recent years the exportation of the edible fungus, *Hirneola polytrichia*, has become an important industry in New Zealand. This fungus is saucer-shaped, three to seven inches in diameter, dark reddish brown on the inside when dried, and gray on the outside. It is said that the odor of these plants distinguishes them for botanists, but their chief peculiarity is their growth. They spring up, it is believed, by hundreds and thousands in a night, being produced, not from seed, but by a spawn which bears organs of fructification. Another peculiarity is that they absorb oxygen and give out carbonic acid, like animals, while other plants absorb the latter and give out the former. The commercial fungus of New Zealand is found in the North Island, on various kinds of decayed timber, all the fungi, as is well known, favoring damp situations. Nine-tenths of the Province of Taranaki, 80 miles by 70 in extent, where it is found, is densely wooded. The plant is found in what are called new bush settlements, made by laboriously clearing. The branches are lopped off and burned, the trunks, resting on their own spurs and sometimes on scaffolds built for them to fall on, begin to decay—not lying prone on the ground—and the fungus grows. It is prepared simply by letting it dry. China is its market, and it was at first bought up by collectors for a cent per pound, and sold in San Francisco for fifteen and in Hong Kong for twenty-three. According to the Colonial Secretary of Hong Kong, the fungus is much prized there as a medicine, administered in the form of a decoction, to purify the blood; it has also been reported to be in use in China and Japan as a dye for silks. But its principal use among the Chinese is as an article of food; it forms the principal ingredient in their favorite soup, for which it is highly regarded on account of its gelatinous qualities and its rich flavor.

Peanuts.

Although the peanut merchant, with roasting mill, may be seen on almost every block in American commercial centers, but few of those who pay their nickel for a heaping measure of these hot ground nuts have any idea of the extent of the trade in bushels or its value in dollars. According to the Cincinnati *Price Current*, the crop this year will be less than half what it was last year. It then amounted to 2,370,000 bushels, valued at $2,150,000, about two-thirds of which came from Virginia. Of the balance, 750,000 bushels came from Tennessee, and 120,000 bushels from North Carolina.

Nickel Plating.

A simple process of nickel plating by boiling has been described by Dr. Kaiser. A bath of pure granulated tin tartar and water is prepared, and after being heated to the boiling point, has added to it a small quantity of pure red-hot nickel oxide. A portion of the nickel will soon dissolve and give a green color to the liquid over the grains of tin. Articles of copper or brass plunged into this bath acquire in a few minutes a bright metallic coating of almost pure nickel. If a little carbonate or tartrate of cobalt is added to the bath a bluish shade, either light or dark, may be given to the coating, which becomes very brilliant when it is properly polished with chalk or dry sawdust.

THE CONDORS AND THEIR YOUNG IN THE DRESDEN ZOOLOGICAL GARDEN.

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.

A Civil Engineer, for many years resident in South America, a good linguist, desires employment in his profession, or as representative of engineering firms abroad. Address A. B., P. O. Box 773, New York.

Beaumont's Draught Apparatus. See page 291. State and county rights for sale.

Carbon Plates and Pencils. 48 H. R. Ave., Jersey City, N. J.

Leather Belting, Rubber Belting, Packing and Hose Manufacturers' Supplies. Greene, Tweed & Co., N. Y.

New Book.—A Treatise on Iron Founding. By Claude Wylie. Written for practical men. Illustrated. $1.40. Send for our catalogue of scientific books. E. & F. N. Spon, 446 Broome St., N. Y.

Garfield and Family.—Elegant engraving, 19 x 24, sent for 24 cents (stamps). Sheehy & Co., 33 Barclay St., N. Y.

Don't fail to see the New Automatic Engine built by the Lambertville Iron Works, now in operation at the American Institute, New York.

Address Penfield Block Co., Lockport, N. Y., for Pulley Blocks, Sheaves, Store and Baggage Trucks, Hand Hoists, Car Pushers.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 285. Totten & Co., Pittsburg.

Farmers desirous of utilizing the immense crop of apples this country will undoubtedly be blessed with during the present year, and thus realize a large amount of money, should at once send to Messrs. Boomer & Boschert, 15 Park Row, New York, for their illustrated circulars, with prices, which are reasonable.

Blake's Belt Studs. The best fastening for leather and rubber belts. Greene, Tweed & Co., 118 Chambers St., N. Y.

Mechanics' Watch, $10. Circul's free. Birch, 38 Dey St., N. Y.

Second-hand Upright Engine, in excellent order, for sale. 6 to 8 H. P. Trump Bros. Mach. Co., Wilmington, Del.

A pair of 15 x 24 Engines, good as new, for sale cheap, as they must be removed. J. C. Todd, 10 Barclay St., N. Y.

Foot Lathes, Fret Saws, 6c. 90 pp. E. Brown, Lowell, Mass.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Cope & Maxwell M'f'g Co.'s Pump adv., page 254.

Punching Presses & Shears for Metal-workers, Power Drill Presses, $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N. Y.

Machine Diamonds. J. Dickinson, 64 Nassau St., N. Y.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. 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.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro. 234 Broadway, New York.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Peck's Patent Drop Press. See adv., page 269.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 10 Cortlandt St., N. Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

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

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

Saw Mill Machinery. Stearns Mfg. Co. See p. 269.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 268.

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

Improved Skinner Portable Engines. Erie, Pa.

The American Electric Co. and Proprietors and Manufacturers of the Thomson Houston System of Electric Lighting of the Arc Style. New Britain, Conn.

See Bentel, Margedant & Co.'s adv., page 285.

For the best Diamond Drill Machines, address M. C. Bullock, 80 to 88 Market St., Chicago, Ill.

Clark & Heald Machine Co. See adv., p. 286.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 286.

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

Gear Wheels for Models (list free); Experimental Work, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Gould & Eberhardt's Machinists' Tools. See adv., p. 286.

The Medart Pat. Wrought Rim Pulley. See adv., p. 285.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 286.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 285.

Engines, 10 to 50 H. P., $250 to $500. See adv., p. 286.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 285.

Drop Hammers, Power Shears, Punching Presses, Die Sinkers. The Pratt & Whitney Co., Hartford, Conn.

Pays well on small investment.—Stereopticons, Magic Lanterns, and Views illustrating every subject for public exhibitions. Lanterns for colleges, Sunday schools, and home amusement. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., N. Y.

Safety Boilers. See Harrison Boiler Works adv., p. 285.

Telegraph, Telephone, Elec. Light Supplies. See p. 285.

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

Supplee Steam Engine. See adv. p. 270.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 286.

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.

4 to 40 H. P. Steam Engines. See adv. p. 254.

The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Av., Phil. Pa.

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.

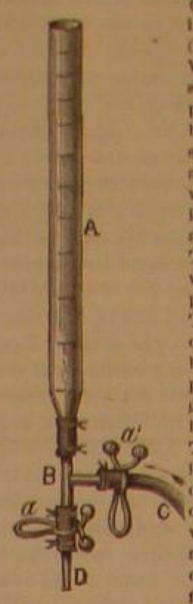
(1) A. W. P. asks: Will you please give your readers some facts in regard to kerosene lamps and oil? Is it essential that a kerosene burner have any air vent? I have one that has no perceptible vent, yet it burns beautifully. I have another that has a hole big enough to run a No. 8 wire through it to the oil; that lamp sings and flickers, and when I blow it out it will fluctuate several times before it will go out. Now, is not that lamp dangerous? I would stop the vent if you think it advisable. Why does a lamp sing and why it flickers in a close room where there is no draught of air to disturb it? If the socket that fits on to the lamp gets so hot that it burns your fingers, is it not dangerous? If the oil will not flash up when a match is thrown into it, but burn for several seconds before the oil takes fire, is that oil a safe oil to burn, or had the oil ought to be as hard to ignite in the same manner as lard oil? Can you inform us whether there is any sign of danger from a lamp preparatory to its exploding? A. All kerosene burning lamps should be provided with some kind of air vent, but it is not desirable to have too large a vent. In some the aperture formed by the wick wheel is all sufficient; in others a small flat vent tube is soldered to the side of the wick tube. If the vent is too large a slight disturbance of the oil causes flickering. The "singing" and flickering may be due to an imperfect air supply, poorly fitting wick or chimney. As ordinarily constructed the brass burner and collar of lamps often get heated to 100° Fah., or over, especially if allowed to burn low for several hours. If good oil is used there is little danger attending this. With regard to what constitutes good burning oil and what are the conditions of safety in using it, see Non-Explosive Kerosene, page 1112, current volume.

(2) C. A. B. speaks of his saw mill. I would say that a large amount of his power is lost in driving so much useless gearing. A thirty-five inch Leffel wheel making some 100 to 140 revolutions, if the water is clean and free from anchor ice in winter, may be fitted with a bevel mortise (wooden cogged) wheel on its shaft of four feet or more in diameter (better larger so as not to get the pinion too small), working into an iron pinion of one-fourth or fifth on the saw mandrel, and do good work, if only driving the saw, and its appurtenances. He may drive his 48-inch saw 700 revolutions or more to do the best work. I know of a saw thus rigged doing fair work with only ten feet head. Of course more head would be better.

(3) W. A. writes: I am in business here and am under considerable difficulty regarding the best mode of heating tires for cart and other wheels. Would you please, through your valuable columns, explain the best sort of furnace for the purpose? A. Heating tires for shrinking on wheels, as generally practiced here, is by laying the tire on a large cast iron plate with a hole cut out of the center, say 2½ feet diameter; a wood fire is then built all over, and covering it and kept burning until properly heated.

(4) L. H. C. says: I want to make T's out of India-rubber tubing. What kind of cement can I make the joints with? How must the cement be mixed? A. The cement commonly used by rubber manufacturers for piecing rubber goods is prepared by dissolving purified gum rubber in benzine. The benzine may be put into a large, narrow necked bottle, and this suspended in a vessel of warm water (away from fire). The rubber is added gradually with occasional agitation until a liquid of the consistence of thick molasses is obtained. The parts to be joined are thinly but uniformly smeared over with this, and exposed to the air for a few minutes before bringing the pieces together. The joint should be placed under pressure in a warm place for forty-eight hours or more before using. Gutta percha cements, also marine glue, can often be advantageously employed in place of the rubber cement. See Cements, page 2510, SUPPLEMENT, No. 158. Where the joint has to sustain rough handling or strain, it is usually preferred to insert in the joint a thin T-joint of hard rubber or metal.

(5) F. A. W. asks for the simplest method (or the usual method) of filling a large number of small (one-eighth ounce) bottles. When the bottle is opaque, I should suppose something to permit only enough to fill the bottle flow out would be necessary. A. One of the simplest arrangements for filling vials with liquid is the following: A is a piece of glass tubing graduated as to contents by file marks. The lower end, drawn out somewhat, is connected by a short piece of rubber tubing with the T-shaped glass tube, B, the other limbs of which are closed by rubber tubing and spring pinch cocks, *a a'*. D is a small glass delivery tube, connected by the rubber tubing with B. The end of the rubber tube, C, is connected with the reservoir of liquid, so that when *a'* is opened and *a* closed, the liquid will flow into the graduate, A, and when *a'* is closed and *a* opened, a measured quantity flows out through D into the vial.



(6) G. A. H. asks: 1. Is the current from a dynamo electrical machine as at present made capable of decomposing water with the same facility as the galvanic current? A. Yes. 2. How many cubic feet of each gas could be produced by a small machine, say, one-half horse power, per hour? A. It would depend altogether on the construction of the machine. 3. Providing the latter could be run by water power, storing up the gases during the day, could not the calcium light be produced for evening use almost without expense? A. This is impracticable.

(7) F. R. F. asks: What gum is used in the preparation of the so-called "ready mixed or patent" paints? A. You should send a labeled sample of the paint referred to.

(8) W. A. T. asks: Will you please explain why the symbol for nitric acid is "A_2O_5HO," instead of "N_2O_5HO," in the article on the "Manufacture of Oxygen from the Air," in your issue of October 1, 1881, on page 4784? A. It should read "$N_2O_5H_2O_2$" or "$(HNO_3)_2$" and not "A_2O_5HO."

(9) C. E. S. asks: 1. Will sulphate of copper cell, four quart size, answer for electroplating small articles? A. If the objects to be plated are small, such a battery will answer. 2. Can plain work done with such battery be burnished with an ordinary burnisher? A. Not very well. Gold and silver can be deposited so as not to require burnishing. Electroplated work is usually finished by buffing. 3. How expensive are the batteries such as you described in a recent number of SCIENTIFIC AMERICAN as capable of maintaining one arc light with flannel envelope, etc.? A. Such a battery can be constructed for $20. 4. Can it be used for electroplating? A. Yes, if properly adjusted to suit the requirements of the work.

(10) O. P. L. asks: 1. Can water be heated higher than 212° Fah., under any circumstances? A. Yes; we do not know that there is any limit to the temperature to which it can be raised under pressure. 2. If a belt be connected from a fly wheel of an engine to another wheel of same diameter on a shaft the same diameter as the engine shaft, which shaft will bear the most resistance? A. The shaft of the prime mover.

(11) E. S. asks: 1. How can I make a mucilage for gumming the backs of labels to prevent them from cracking when dry? A. Try the following: Gum dextrine, two ounces; water, five ounces. Heat the water to boiling, and gradually sift in the powdered gum and stir until all is dissolved. If the solution is not thick enough on cooling, add more gum—and *vice versa*. It should not be too liquid. Dampen the paper well before gumming. Put under strong pressure when dry. See article on Postage Stamps, page 212, current volume. 2. How can I silver articles that have already been silvered, but from which the silver has worn off? A. For information on silverplating see silver deposit, p. 81, vol. 44. 3. The proportions of tartaric acid and bicarbonate of soda for making soda water? A. Common lemon soda, without a machine, is prepared as follows: Put into each bottle 2 drachms of sugar, 2 drops of essence of lemon, half a drachm bicarbonate of potash, and water to fill the bottle; then drop in 35 or 40 grains of tartaric or citric acid, and cork immediately, placing the bottles in a cool place, or on ice.

(12) W. G. L. asks: 1. What are the ingredients, and how is the cylinder oil known as "valvoline" made? A. We are unable to give you the composition of the lubricant. 2. Is it a patented article? A. We believe not. 3. Are the substances known to oil dealers as French de gras and French grease the same thing, and where and from what are they made? A. Yes.

(13) D. F. asks: Will you please tell me how so-called cameo painting on glass is done—I mean the kind that is done between two pieces of convex glass, and the picture appears larger than the one it was taken from? A. The transparent colors used are Prussian blue, gamboge, carmine, verdigris, madder brown, indigo, and crimson lake. The semi-transparent include raw sienna, burnt sienna, cappah brown, and Vandyke brown. The vehicles used are oil, megilp or gum water, or warm gelatine solution. With the latter some of the coal tar dyes are available, but though producing rich effects, most of them are apt to fade on exposure to light. The colors are applied with a camel's hair pencil. The magnifying effect is due to the lense-shaped glass covers.

(14) F. J. M. says: Referring to your reply to R. E. M., describing method of taking cast of human face, how are the eyebrows, lashes, and the long hair of a female subject prepared so as to keep them from bedding into the soft plaster? I hardly think that oil would be sufficient. A. Smooth the hair as evenly as possible, moisten the surface with gum tragacanth water, and when this has dried, oil. Wax and soap may also be used.

(15) H. C. asks: Will you please state how much I can practically compress a gas without changing its nature? To explain: suppose I have a vessel of one cubic foot capacity, how many cubic feet of gas can I force into said vessel? A. Pressure does not alter the nature of gases. A gas may be compressed up to its point of liquefaction. A pressure of a few atmospheres is sufficient to liquefy some of the gases, while others remain in the gaseous state (at ordinary temperatures) under pressures equal to twenty tons per square inch.

(16) E. L. W. asks: Can you inform me how water glass is made and how the sirupy solution of water glass is prepared? A. You will find the information required in article on Water Glass, page 16, No. 2, current volume.

(17) E. H. L. says: I have just painted an iron fence with a paint composed of boiled linseed oil, asphaltum and naphtha. The work showed at first a very brilliant black coat. The first rain colored it dirty brown, destroying the gloss. Can you suggest any addition—inexpensive preferred—to retain in a measure the gloss on exposure to the weather? I have always understood asphalt to be much better than coal tar. The work was perfectly dry before it was touched by the rain. A. We know of no cheap substance the addition of which would make the gloss permanent. Lampblack will make the paint blacker. Such paints or varnishes are greatly improved by boiling the oil and bitumen together for twelve hours or more before thinning down for use. A good iron work black is prepared as follows: Put forty-eight pounds asphaltum into a capacious iron pot, and heat to boiling for four hours; during the first two hours introduce seven pounds of red lead, seven pounds of litharge, three pounds of dried copperas, and ten gallons of boiled linseed oil; add one eighth pound run of dark gum, with two gallons of boiled oil. After pouring the gum and oil continue the boiling for two hours, or until a sample of varnish will roll up into hard pills when chilled. When cooled somewhat take it out of doors and thin down with about thirty gallons of oil of turpentine. 2. What substitute cheaper can I get for outside ink in place of boiled linseed oil? Some drying oil, I suppose, is needed. A. Linseed is the best and cheapest oil for this purpose.

(18) J. H. asks: Will you please inform me of the best method of preparing cloth so that by placing it between two sheets of writing paper and writing on the top sheet with a pencil or other sharp instrument it will make a copy on the under sheet? A. Manifold paper is prepared as follows: Mix with cold lard a sufficient quantity of lamp black or fine ivory black to produce a thick smooth paste, smear this over the cloth (or paper unglazed), rub it in with a cloth pad, and then rub off any excess with a piece of flannel. For blue use Prussian blue instead of the black pigments, for green chrome green, for red cochineal or vermilion.

(19) D. C. asks: Can you give us a good recipe for enameling or porcelain lining for iron hollow ware such as wash bowls, sinks, etc.? A. Flint (quartz), calcined and ground, one hundred pounds; borax glass (anhydrous borax) ground, fifty pounds. Mix, fuse together in a crucible, and let it cool slowly. Powder and mix forty pounds of this glass with five pounds of kaolin (white potter's clay), and grind the mixture to a fine paste in water; pickle the vessel in dilute sulphuric acid, and scour with sand to thoroughly cleanse its surface; then line it with a coating of the above paste about one-sixth of an inch thick, and let it stand in a warm room until the coating has partially dried. Next dust over the surface of the paste coating (still moist) the following powder, and dry in an oven at 212° Fah.: White glass, free from lead or arsenic, one hundred and twenty-five pounds; borax, twenty-five pounds; carbonate of soda, fused, powdered, moistened with water and dried, twenty pounds. To forty-five pounds of this add one pound soda. Mix thoroughly with a little hot water, dry, and reduce to fine powder. When the coating on the iron has dried, the vessel is put in a muffle and the heat gradually increased until the glaze fuses, when it is taken out, more glaze powder is dusted on, and after a second heating allowed to cool very slowly. Some of the glazes employed consist of variable mixtures of feldspar, sodium carbonate, borax, and oxide of tin. Feldspar is also sometimes added to the enamel body.

(20) W. F. S. asks: What can I use on polished brass to prevent tarnishing, etc.? Is there anything better than alcohol and shellac? A. See Lacquers for Brass, page 209, vol. xliv.

(21) A. B. says: I have a lot of nearly dry alcoholic fruit and root extracts. Could these be used advantageously for fertilizing purposes in an orange grove? If not could anything be added to them that would make them available for the purpose? A. Such extracts contain nothing that would make them valuable as fertilizers, and we know nothing that can be added to them that will make them specially useful for this purpose.

(22) E. D. S. asks: Would three gravity batteries placed in a cellar where there is milk make it sour? A. No.

(23) H. L. writes: I am running an engine of 20 inch bore and 36 inch stroke about 55 to 60 revolutions per minute with 65 to 70 pounds steam pressure. Said engine has a valve at each end, and the ports are 10 inches wide and open one full inch. The steam pipe is 5 inches in diameter. Are the ports in proportion to the size of engine as also to the steam pipe? A. We think both your ports and steam pipe should be at least one half larger, and would be better if double the present size.

(24) Dr. F. A. R. asks: Will you please inform me through the Notes and Queries column of your next issue, with what should bone ash be mixed, and also directions for making a bone ash cupel, as shown in SCIENTIFIC AMERICAN, May 28, 1881, page 339? Can bone ash, good enough for making cupels, be prepared by burning bones and grinding? By passing a stream of H_2S into $(NH_4)OH$ (spec. gr. 0·96) until saturated, and then adding an equal volume of $(NH_4)OH$, will it not give $(NH_4)_2S$? What is the difference in the preparation of $(NH_4)SH$, $(NH_4)_2S$, and $(NH_4)_2S_2$? I noticed in the tests for metals of the different groups in a qualitative analysis which I have, that some of the tests require one of the above reagents and some require another, and I wish to ask if it is necessary to have all of the reagents, or will the ammonic disulphide answer in place of the others? A. Take bones or boneblack and calcine them in an open crucible until all the animal and carbonaceous matters have been destroyed and the residue becomes whitish; cool and empty the contents of the crucible into clean water, and give it repeated washings in fresh waters to remove all soluble matters. Drain on a filter and dry. When required for use moisten with water (or beer) in about the proportion of eight of ash to one of liquid. It is then ready for the mould. When moulded the cupel must be dried slowly by the stove, then heated in the muffle to bright redness before it receives the charge. There are two or three points to be observed in making the best cupels: First, the powdered bone ash must be of a certain degree of fineness; secondly, the paste must be neither too soft nor too dry; and thirdly, the pressure must be made with a certain degree of force. A coarse powder only slightly moistened and compressed furnishes cupels which are very porous and break on slight pressure, and which allow small globules of metal to enter their pores occasioning loss. When the powder is too moist and too strongly compressed the cupel does not absorb readily—soon becoming choked or clogged—and requires too high a temperature to complete a cupellation. The action of hydrogen sulphide upon ammonia gives rise to the formation of $(NH_4)_2S$. [$2NH_4(OH)$ and $H_2S = (NH_4)_2S$, and $2(H_2O)$], then of NH_4SH; upon addition of the same quantity of solution of ammonia as has been saturated, the ammonia decomposes with the ammonium hydrosulphide and ammonium monosulphide is formed thus: $NH_4SH + NH_4OH = (NH_4)_2S + H_2O$. The rule is, however, to add only two-thirds of the quantity of solution of ammonia, as it is better the preparation should contain a little ammonium hydrosulphide than that free ammonia should be present. To employ ammonium hydrosulphide instead of the monosulphide is unnecessary.

(25) F. R. E. asks: Will you inform me why it is that the water always rises in all the small streams in the fall? A. We think you are mistaken in your premises. Streams rise in the fall and spring after rains; but we think that during this fall the drought has diminished the streams.

(26) G. E. T. asks: 1. What is the battery power required to run an Edison lamp? A. From 100 to 140 cells of carbon battery. 2. Will any part of the secondary battery need renewal after continued use? A. The acidulated water is liable to become decomposed. In other respects we think the battery is permanent.

(27) A. F. W. asks: 1. Is the current generated by a dynamo electric machine always of exactly the same strength for the same speed of the machine? A. Any variation in the resistance of the external circuit will change the strength of the current. 2. Can the difference in strength be made noticeable for a change in speed of five revolutions? A. Yes. 3. What is the most practical and reliable instrument for observing the changes in strength, due to changes in speed? The generator is supposed to be one of the smallest sizes that can be had. A. A galvanometer placed in a shunt circuit.

(28) C. B. B. writes: I made a Holtz electrical machine from directions in SUPPLEMENT, No. 278, and am unable to charge it. I used tin foil, well insulated about the edges, for inductors, and the revolving plate does not turn quite true. If you can give any information that will help matters you will greatly oblige. A. A Holtz machine will not work in sultry summer weather. If your machine is made according to directions given in the SUPPLEMENT it will work well most of the time from now until warm weather in the spring.

(29) W. M. B. asks: Why is it that some banks do not take gold and silver coin that has holes punched in it, or is mutilated in any manner? What is the value of it in that case? A. There is no provision for the redemption of mutilated silver coin, and as it is not a legal tender, and has a value as bullion only, bankers and others are justified in refusing to redeem it. Mutilated gold coin is a legal tender at a valuation in proportion to its actual weight, according to Section 3585 Revised Statutes, which provides that: "The gold coins of the United States shall be a legal tender in all payments at their nominal value, when not below the standard weight and limit of tolerance provided by law for the single piece, and when reduced in weight below such standard and tolerance shall be a legal tender at valuation in proportion to their actual weight." This section seems to have been overlooked or ignored by the banks and treasury officials, but we presume now that so much interest is taken in mutilated coin that arrangements will be made to retire mutilated gold coins.

(30) E. L. C. asks: Will you please inform me where I can obtain any knowledge concerning the liquefaction of the so-called permanent gases O, H, N, by Cailletet of Paris, and Pictet of Geneva, in 1877. A. See pp. 2030-31, SUPPLEMENT, No. 128, also SUPPLEMENTS, Nos. 116 and 118, and SCIENTIFIC AMERICAN, vol. xxxviii, pp. 64 and 73, 111 and 186.

(31) R. L. N. writes, in answer to O. R. M: I have effected nearly a complete cure for dandruff, by washing with a solution of borax once each tenth day, and using bay rum each alternate day. At first use it every day.

(32) H. H. W. asks: Is there any method of closing an electric circuit through the agency of light? A. It can be done by means of a selenium cell, or by some modification of the radiometer.

(33) J. W. K. asks: What power in tons will it take to punch one inch round hole through one inch iron? A. From fifty-five to sixty-five tons, depending upon the quality of the iron.

(34) W. R. M. writes: My residence is about 200 feet from telephone office. I desire some arrangement by which I can, while at my residence, hear the ring or call on the call magneto bell at the office. 1. Can I attach an electric bell placed in my dwelling to the telephone line wire outside my office and thus catch the call? A. Yes, by cutting the wire and inserting a call adapted to the line. 2. What would such bell cost, and name of bell? A. It is probable a bell with a polarized armature would be required. You can obtain particulars by addressing electricians who advertise in our columns. 3. Would an extra cell of battery be necessary? If so, what kind? A. If the call is made by means of a magneto machine a battery will not help you. We cannot give you practical advice without knowing more of the detail of your line.

(OFFICIAL.)

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FOR WHICH

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AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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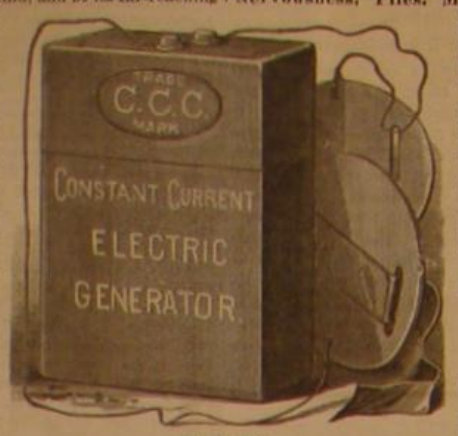

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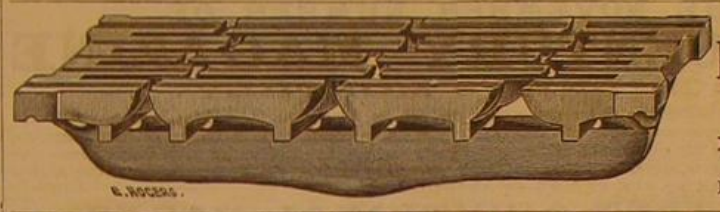

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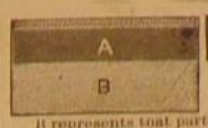

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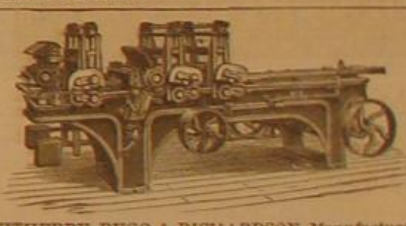

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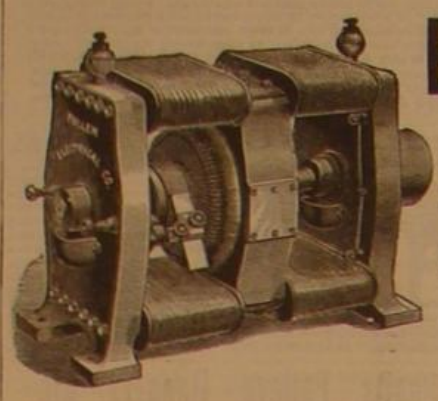

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FOURTEEN ADDITIONAL PAGES.
The November number is one of rare beauty and interest. It is richly illustrated with more than seventy engravings, among them a frontispiece
PORTRAIT OF GEORGE ELIOT,
the only authorized portrait of the great novelist yet published or to be published, furnished by her husband, Mr. Cross, and reproduced from an etching made especially for this purpose by M. Paul Rajon. It accompanies a paper by Frederick W. Myers, who deals interestingly with George Eliot's religious and philosophical beliefs.
Mrs. BURNETT'S NEW NOVEL, "Through One Administration," a story of social and political life in Washington, begun in this number, is expected to rival in interest the writer's "That Lass o' Lowrie's," and "A Fair Barbarian."
MARK TWAIN contributes a complete short story, entitled "A Curious Experience."
Mary Hallock Foote furnishes an entertaining paper on
A DILIGENCE JOURNEY IN MEXICO,
With eight of her own illustrations, engraved by Cole, Closson, and others. An article on
IMPRESSIONS OF SHAKSPEREAN CHARACTERS,
By Tommaso Salvini, the eminent Italian Tragedian, will attract wide attention. There is also a paper on Salvini, with drawings of him in Othello and Macbeth.
"COSTUMES IN THE GREEK PLAY AT HARVARD,"
By Frank D. Millet, the artist who designed the costumes for the play, includes seventeen striking illustrations by Brennan. An opportunity for reproducing seven magnificent paintings is afforded by a paper on the artists **FORTUNY AND REGNAULT.**
"Around Cape Ann" is a breezy 'longshore article illustrated with nine exquisite reproductions of etchings by Stephen Parrish.
"MY ESCAPE FROM SLAVERY," By Frederick Douglass,
Is a paper of historical value and interest. W. J. Stillman has an interesting article, with twenty-five illustrations, on the discovery and origin of **"The So-called Venus of Melos" (Milo).**
There is a capital short story by the author of "The Village Convict" (in the August SCRIBNER); an article by a Cunard captain on "Compulsory Lane Routes in the North Atlantic;"
POEMS BY
James Russell Lowell, Edmund Clarence Stedman, Edmund W. Cosse, Austin Dobson, Mary Mapes Dodge, Richard Watson Gilder, and others.
"Topics of the Time" contains contributions from the pen of the late Dr. Holland on the change in the name of the magazine, on "The Contingency of 'Inability,'" and "Public Spirit." This November number contains the year's prospectus.
The following is a summary of some of the
LEADING FEATURES FOR THE COMING YEAR,
In addition to Mrs. Burnett's new novel:
STUDIES OF THE LOUISIANA CREOLES. By Geo. W. Cable, author of "The Grandissimes," etc. A series of illustrated papers on the traditions, language, social customs, and romance of Creole life in Louisiana. Mr. Cable's novels have already revealed to American readers the unique interest that invests this subject.
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SCENES OF THACKERAY'S, HAWTHORNE'S, AND GEORGE ELIOT'S NOVELS. Succeeding the illustrated series on the scenes of Dickens's Novels.
THE REFORM OF THE CIVIL SERVICE being the most pressing political question before the American public, arrangements have been made for the early publication of a series of papers on different phases of the subject, by several of the ablest advocates of the reform.
POETRY AND POETS IN AMERICA. By E. C. Stedman. There has been no such important body of literary criticism in America in the last fifteen years as Mr. Stedman's papers in SCRIBNER on English and American Poetry. The studies of Longfellow, Whittier, Emerson, Lowell, and others will appear in THE CENTURY MAGAZINE.
STORIES, SKETCHES, AND ESSAYS may be expected from Charles Dudley Warner, W. D. Howells, "Mark Twain," Edward Eggleston, Henry James, Jr., John Muir, Miss Gordon Cumming, "H. H.," Geo. W. Cable, Joel Chandler Harris, Lizzie W. Champney, A. C. Redwood, Charles de Kay, F. D. Millet, Noah Brooks, Frank R. Stockton, Mrs. Julia Shayer, Wm. H. Rideing, T. R. Lounsbury, Constance F. Woolson, H. H. Boyesen, Albert Stickney, Washington Gladden, John Burroughs, Parke Godwin, Tommaso Salvini, Henry King, Ernest Ingersoll, E. L. Godkin, E. B. Washburne, and many others.
During the year, one or two of the unique papers on the adventures of "The Tile Club" will be printed. An original Life of Bewick, the engraver, by Austin Dobson, illustrated with many reproductions of his engravings, is in preparation, with other features to be later announced.
THE EDITORIAL DEPARTMENTS will be unusually complete. Reviews of the best and most significant books will be continued. "Home and Society" will have a wider range of subject, and "The World's Work" is so frequently the source of quotation by scientific and industrial journals that its enlargement seems to be demanded.
The price of THE CENTURY MAGAZINE will remain at $4.00 per year (35 cents a number). The portrait of the late Dr. Holland, photographed from a life-size picture by Wyatt Eaton, and issued just before his death, will possess a new interest to the readers of this magazine. It is offered at $5.00 retail, or together with THE CENTURY MAGAZINE for $6.50. Subscriptions are taken by the publishers and by booksellers and newsdealers everywhere.
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OUR GRAIN CROP AND ITS COMMERCIAL IMPORTANCE.

During the past decade the production of breadstuffs in this country, as shown in the latest census reports, has been nearly doubled. During the same period the exportation of breadstuffs has increased fourfold. It is now more than ten times as great as it was twenty years ago, and more than twenty times what it was thirty years ago. As given by the Bureau of Statistics the total exportations were:

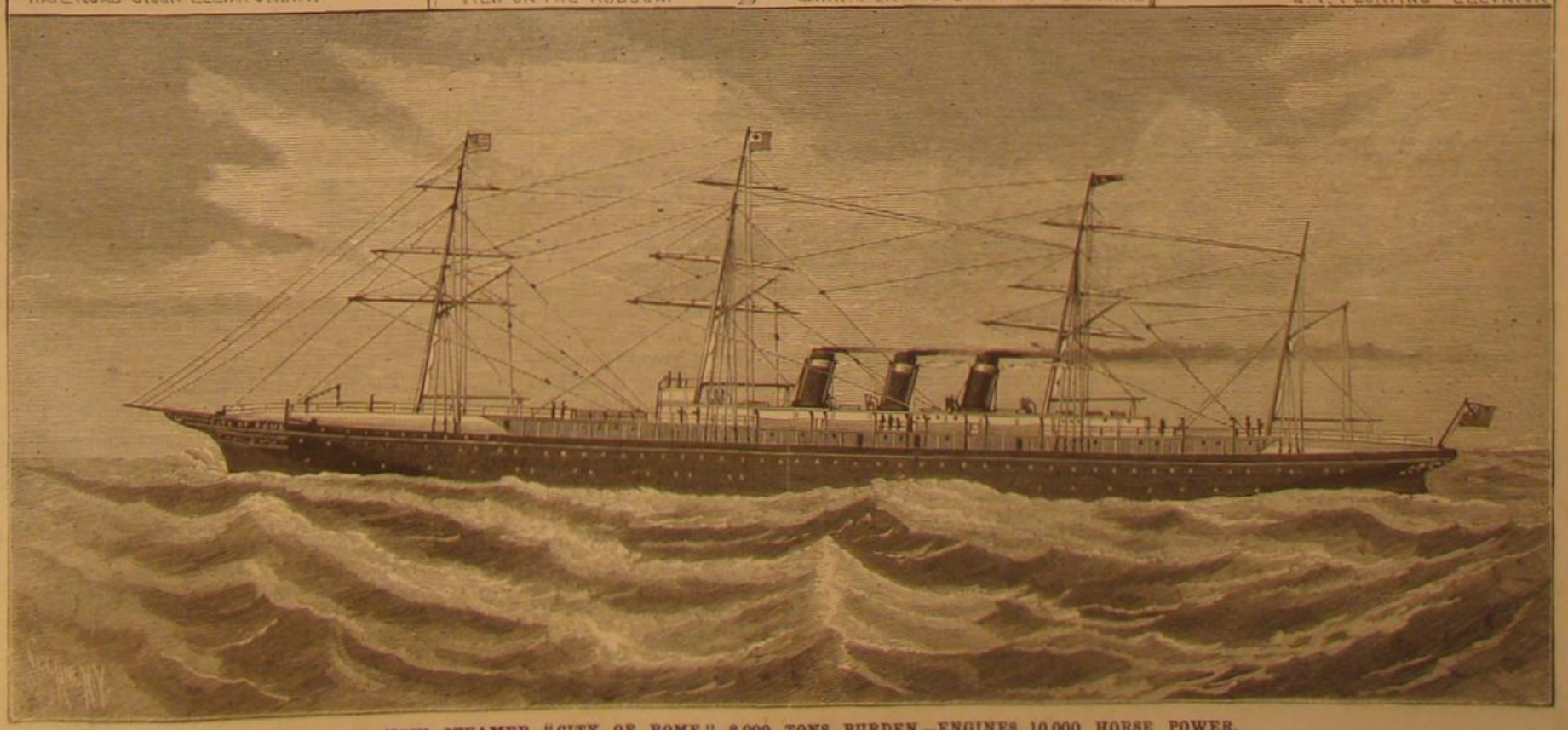
In 1850	$13,066,509
" 1860	24,442,320
" 1870	72,950,933
" 1880	288,036,835

In 1850 the total production of wheat was a little over a hundred million bushels, of which the portion exported was less than four-fifths of one per cent. In 1880 the yield was close upon 450,000,000 bushels, of which 34¼ per cent was exported. Of the second great staple, corn, the yield in 1850 was nearly 600,000,000 bushels, of which 1·11 per cent was exported. In 1880 the yield was nearly 1,548,000,000 bushels, 6·34 per cent being exported. The entire grain crop of last year—corn, wheat, barley, oats, rye, etc.—approached 2,700,000,000 bushels, valued at $2,000,000,000. During the first eight months of the current year the exportation of breadstuffs has exceeded $20,000,000 a month, a material falling off from last year's business, owing partly to better crops abroad and partly to the fact that prices have been kept up by speculative holding of grain for higher prices.

The apparent increase in the corn crop during the past decade was 133 per cent. In the census year (1879) the three principal corn-growing States produced more corn than the entire country did in 1869. The increase in Kansas was fivefold, and in Nebraska still greater.

The gain in the wheat crop was 73 per cent in the last

[*Continued on page* 308.]



THE NEW STEAMER "CITY OF ROME," 8,000 TONS BURDEN.—ENGINES, 10,000 HORSE POWER.

THE COMMERCE OF NEW YORK.—TRANSPORTATION, STORAGE, AND SHIPMENT OF GRAIN.

Scientific American.

ESTABLISHED 1845.

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NEW YORK, SATURDAY, NOVEMBER 12, 1881.

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THE NEW LYMAN-HASKELL CANNON.

The Lyman-Haskell accelerating or multicharge cannon is made with a succession of cylindrical chambers called "pockets" below the bore whose axes point toward the muzzle of the gun and form with its axes angles of about 60 degrees. In these pockets are placed the accelerating charges of powder that ignite after the passage of the projectile, which is started by the explosion of the initial charge in the gun chamber, in the usual manner.

Col. J. H. Haskell, of New York, adopting the accelerating principle first introduced by A. S. Lyman, also of New York, the inventor of the "Lyman accelerating gun," has made a number of improvements on it which are now the property of these two gentlemen jointly with their assigns.

The new Lyman-Haskell gun is expected to throw a projectile four calibers in length a distance of ten or twelve miles, leaving the gun at a velocity of 4,000 feet per second, which, it is claimed, can be done without the danger of bursting the piece, which would occur if the necessary force were generated by the explosion of a single charge.

A number of tests of the principle have been made; notable among them are those at the Washington Navy Yard, where a 2½ inch accelerating gun was tested in competition with a 5 inch Whitworth (English) gun. The target consisted of 5 inches of iron plates backed with 18 inches of oak timber. At a distance of 200 yards, the projectile from the accelerating gun went entirely through this target and landed 100 yards beyond it, while the English projectile fired from the same distance, with double the charge of powder, failed to penetrate the same target. Gen. John Newton, U. S. Engineers, finds that a 10 inch accelerating gun will be as efficient as the 81 ton Armstrong, while a 12 inch accelerating gun will be more powerful than the 100 ton Armstrong.

On the 24th of October a casting was made at the "Scott Foundry" of the Reading Iron Company, for a 6 inch Lyman-Haskell gun. This casting is made without cores, and is to be bored for the pockets and will form the breech section of the gun. Its weight is upward of 50,000. It was cast from two reverberating furnaces charged with 56,000 pounds of cold-blast charcoal pig-iron of the following brands:

Brands.	No. 1 Furnace.	No. 2 Furnace.
Maiden Creek	3,680 pounds.	2,745 pounds.
Juniata	3,670 "	2,745 "
No. 2 Richmond	15,425 "	11,555 "
Falling Spring and No. 1 Franklin	4,775 "	3,575 "
Remelted iron	4,545 "	3,400 "

The section to form the muzzle portion will be cast separately, and firmly joined by socket to the breech section. The whole is to be then lined with steel in one continuous cylinder for the bore and smaller ones for the pockets.

The weight of the gun when completed will be 25 tons, with a total length of 24 feet 11½ inches. It will have a bore of 6 inches, and will carry a ball weighing 150 pounds, of 4 calibers length. Eighteen pounds of hexagonal powder will be used in the breech, with 28 pounds of powder of finer quality in each of the four pockets, making a total of 130 pounds. This is one hundred pounds more of powder than is ordinarily used, and by means of this system of explosion, the projectile will have a penetrating power as 1½ is to 4, compared with other cannon. The initial velocity of the ball will be 4,000 feet in a second, while that of other guns is from 1,500 to 2,000. The ball is calculated to penetrate two feet of wrought iron at a distance of 200 yards. By means of the successive discharges of powder from the four pockets the pressure upon the ball will be maintained, thus giving it its great velocity, which will carry a ball twelve miles. The explosion takes place in tough steel, supported by the strongest cast iron. After its completion, which will be in several months, the gun will be taken to Sandy Hook, where it will be thoroughly tested in the presence of army officers and distinguished scientists.

Conventionality in Designing.

An instructive commentary on our recent criticism of the conventional work of the art schools, as contrasted with the genuinely artistic work of our tool makers and machinists, is furnished by the recent competition in wall paper designs instigated by Messrs. Fuller & Warren.

Speaking of the disappointment occasioned by the designs sent from France the critic of a morning paper says:

"Without being able to lay our hands at once upon the original sources of these designs—without even wishing to say that they are copies—we yet know that there is nothing in them that is not familiar; they are mere variations, and not at all clever ones, on the fashionable stock-in-trade of the day. Some of them are suggestive of the tapestries of French manufacture. One of them has a "filling" that is inspired by Persia; there are two very good borders, skillful treatment of old models, but of the most of them Japan is the fruitful mother—Japan treated rather cavalierly, after the French fashion. But whatever it may be—tapestry, Persia, or Japan—it is all copying, skillful, accomplished and thorough workmanship, but all inspired by books and all drawn from the brains of other men."

In a later paper, speaking of the absence of originality displayed in nearly if not quite all of the designs submitted, the critic is constrained to say that "it is beginning to be felt that the production of good designs by any of the now long-tried methods of art schools, schools of design, South Kensington schools, and the like, is less and less to be depended on. There has been for some time in England much groaning and complaint over the failure of the costly governmental methods employed to stimulate the faculty of design in the British subject, and whether the peoples of the continent are as well alive to their own failure or not, it is nevertheless true, that not only the Germans, the Austrians, and the Italians, but even the French, are reduced to the imitation of the work of the past in every department of manufacture calling for design. It is true they have carried this imitation, not only in the design, but in the manufacture itself, to the very highest point of perfection, so that the brocades and stuffs of all kinds, the metal works, the ceramics, the tapestries, carving in wood and stone, the glass, etc., that are produced to-day are, in all cases where price is of no importance, as well made as they ever were at any time, and even when a cheaper market is looked for these things are often of a very high degree of excellence. But original design has by no means kept pace with manufacture, and though there are a few striking exceptions to the statement, it may be safely said that in design to-day we are dependent on the work of those who have gone before. The design of to-day consists in clever copying or clever combining of what has been produced by other people in other times."

Medals for Electric Lights.

The jury of the International Electric Exhibition has awarded gold medals of the highest class to Edison and Brush for dynamo-magnetic machines, and a gold medal to Maxim. Also, gold medals to Edison, Brush, and Maxim for arc incandescent lights. Edison takes five gold medals in all, being more than any other exhibitor.

Copper in Subnitrate of Bismuth.

It is well known that commercial bismuth often contains copper, and that even when the percentage of copper is too small to color the nitric acid solution, the blue becomes very perceptible upon the addition of ammonia for the purpose of precipitating the subnitrate. At first thought we are inclined to think that the ammoniacal compounds of copper, being very soluble in excess of that alkali, would be easily removed by washing, but experience proves that this is not the case, as no ordinary care, nor even extraordinary perseverance, can remove the blue tint. The following method is, therefore, recommended in cases where it is required to remove copper from bismuth.

The bismuth is first dissolved in cold concentrated nitric acid, preferably an insufficient quantity. On the following day a mass of perfectly white transparent crystals are obtained, from which the bluish mother liquor is to be drained, and the crystals washed with a little strong acid. In a day or two a second crop of crystals are obtained, and are also drained and washed in the same way. If by this time the mother liquor has become dirty or full of black specks, it is filtered through gun cotton. It may be necessary to concentrate it somewhat toward the end to obtain the last crop of crystals. Nitrate of copper, being exceedingly soluble, remains in solution to the last. When no more crystals are obtainable the little bismuth still in solution may be precipitated by ammonia, washed, dried, and worked over again. The different crops of crystallized nitrate of bismuth are triturated with a little water and poured into water, or ammoniacal water, as preferred. In case it is merely precipitated by water, about one-fourth remains in solution, and can be recovered from the filtrate by means of an alkaline carbonate in the form of subcarbonate of bismuth, a preparation of equal value to the subnitrate. Where purification by crystallization has not preceded the precipitation of the subnitrate, the second product, namely, subcarbonate from the filtrate, is frequently of a dark color, since all the foreign metals present in the whole of the original material are here concentrated into one precipitate.

Melbourne Awards.

Messrs. Joseph Burnett & Co., of Boston, received at Melbourne the first order of merit for flavoring extracts and the second order for colognes and chemical products, instead of the second and third orders respectively, as was stated in the report of American awards at that Exhibition printed in the SCIENTIFIC AMERICAN SUPPLEMENT of July 2.

Electric Light in Rail Cars.

Recently the Brighton (Eng.) Railway Company introduced the electric light on a special train of Pullman cars. Thirty-two Faure secondary batteries were employed to the car, to operate a dozen Swan lamps. The illumination was said to have been satisfactory.

A Compressed Air Motor for Elevated Railways.

A very promising trial was lately made of a compressed air motor on the Second Avenue Elevated Road. The air was stored in four tanks, under a pressure of 580 pounds, was stored in four tanks, under a pressure of 580 pounds. After running from 127th street to 42d street and back, making the usual stops, the pressure was reduced to 125 pounds. The inventor claims that with proper facilities at each end of the road the motor can be charged in from two to three minutes time.

THE STRUCTURE OF COTTON FIBER IN RELATION TO DYEING.

The organic structure of the various cotton fibers of commerce, as affecting their use in spinning and weaving, was considered in a previous article. Let us now examine briefly the influence of fiber-structure upon the work of the dyer.

In what manner does the fiber receive the dye, and what changes are wrought in the structure and chemical composition of the fiber in the processes of dyeing?

The fiber, as we have seen, is a slender, twisted, usually more or less flattened cellular tube, the outer walls of which show no openings even under a powerful microscope. When perfectly ripe the fiber consists of almost perfectly pure cellulose, a compound of carbon, hydrogen, and oxygen ($C_6H_{10}O_5$), having but slight affinity for other substances, except strong acids and alkalies.

Obviously there are many supposable ways in which such a structure can be dyed: by the laying on of dyestuff like paint upon the surface of the fiber; by the filling of the tube with liquid dye, which may or may not afterward be precipitated in solid form; by saturating the cell walls with dye; by a chemical union of the substance of the fiber with the dyeing materials, etc.

It is quite probable that each and all of these methods will be found to operate singly or in combination under the varying conditions obtaining in dye houses.

The fixation of the color in the fiber is effected, according to Chevreul, in three ways: by chemical affinity, by simple mixture with the fibers, or by a combination of the two. The English investigator, Mr. Walter Crum, holds that in the dyeing of cotton fiber the action is purely mechanical, and that reactions which occur in the fiber are not effected by the chemical composition of the fiber. The fiber, he says, serves simply as a containing vessel, and is as inert as a glass tube might be. The peculiar structure of the cotton fiber, however, enables it to take in liquids which contain coloring matter in a feeble combination with the solvent liquor, and to retain such matter when the liquid is removed or the dye precipitated by a reagent. The energy of the absorbent action of cotton fiber is so great that some dyes will penetrate the fiber even when the dyestuff is applied in a condition almost solid. Other dyes do not so strongly support the theory of Mr. Crum. Thus, aniline colors, which are eagerly absorbed by silk and wool, have little effect upon unprepared cotton fiber, except to stain the surface.

The more recent investigator, Mr. F. H. Bowman, reviews in his new work the grounds of Mr. Crum's position, and decides that something more than mechanical action is needed to account for the conditions observed under the microscope. With respect to their action upon the fiber of cotton he finds three classes of dyeing substances:

(1) Those which are colored in themselves; simple dyes having a direct affinity for the fiber without the intervention of a mordant.

(2) Those which are true chemical precipitates formed within the fiber walls; with these the fiber acts mechanically and does not in itself undergo any change.

(3) Those requiring a mordant. With these the color is not produced by the simple union of the coloring matter with the fiber, but by the action of various reagents upon the mordant, which unites with the fiber and thus fixes the color.

He adds that it is not possible to draw a sharp line of demarkation between these three classes of action, because in the relationship of various coloring matters to the fibers they shade into one another; and there are many instances in which the difference is only one of degree. Examples of the appearance of fibers under the microscope, after treatment with the different types of dyestuffs, are shown by Mr. Bowman in a series of beautifully colored illustrations.

Turmeric yellow and indigo blue illustrate the action and appearance of the first class of dyeing material. With turmeric yellow the coloring matter is simply dissolved in hot water; immersed in the decoction the fiber speedily acquires a bright yellow color, which is rendered as permanent as the color will permit by simply drying the yarn. The coloring matter is not merely entangled in the cell structure of the fiber, for it cannot be dissolved out by a reapplication of water. There is an evident union of some sort with the fiber substance. The aggregation of coloring matter within the cell walls shows further that the fiber has the power of attracting the dye from the water, which is left considerably less colored than the fiber which has been immersed in it. When examined under the microscope by transmitted light the coloring matter is found to be irregularly distributed, the color lying in detached masses in the cellulose walls. In some places, especially when the fiber is kempy or immature, the fiber seems to have no affinity for the dye and is incapable of receiving it. How far and in what way the presence of foreign matter, such as wax, oil, and cell contents, interferes with the proper action of the cellulose layers and prevents uniform dyeing, does not appear.

The affinity of cotton fiber for indigo is such that the fiber tends to accumulate the indigo within the cell walls in quantity almost proportionate to the time during which it is in operation. With a sufficient quantity of cotton all the indigo may be extracted from the solution.

When the dyed fiber is viewed under the microscope the cloudy deposit of indigo is seen distributed irregularly through the fiber, in some places forming dark, almost black, masses in the central cavity. There is also a certain degree of surface coloration, and an accumulation of color in the creases, on the wrinkled and broken surface of the collapsed tubes, or in the ridges and furrows occasioned by the hollows of the twisted fibers. To the reflecting surfaces so formed the solid and even appearance of this dye is largely due. A careful examination of the best dyed fibers, however, convinces Mr. Bowman that we are far from the standard of perfect dyeing, and that the mechanical treatment of the fiber is much more advanced than the chemical.

The second class of dyeing substances, where true chemical precipitates are formed within the fiber walls, is best illustrated by the pure mineral dyes, such as chrome yellow, Prussian blue, etc. In these the reaction within the fiber producing the color is exactly the same as that which occurs in the test glass on the laboratory table, when testing for lead or iron; and the great problem for the dyer to solve is so to prepare the fiber that it will best receive the solution from which the coloring matter is to be precipitated.

Mr. Bowman finds that in many cases with these purely mineral dyes the cellulose may be entirely dissolved away by properly selected solvents, leaving the dyes in an unchanged condition, showing that they had not entered into chemical union with the fiber. In other cases there seems to be a degree of affinity between impure cellulose as it always exists in the cotton fiber, and the first solutions in which the fiber is immersed in order to produce the purely mineral dyes, so that they may act to some extent as mordants. Thus he found by experiment that when cotton fiber was steeped in acetate of lead (the first process in the dyeing of amber), or in nitrate of iron (the first step in dyeing Prussian blue), he could not by any process which did not entirely destroy the fiber remove all traces of these bases. The inference was that something more than mere mechanical union had taken place between them and the fiber; and although the cellulose itself might play no part in the subsequent reactions, the fixity of the color seemed to be due in part at least to the reaction of the bases upon the cellulose, making the dyes to a certain extent chemical as well as mechanical.

The third class of dyeing substances (where a mordant is used) is greatly variable in nature and application. In some cases there seems to be what may almost be called the formation of a new surface within the fiber walls, or even upon the surface of the thread (but permanently attached to it), upon which the coloring matter is deposited. Thus pure cotton fiber will not receive and hold an aniline dye, but when first treated with a solution of tannic acid the fiber will take up the color in large quantity and hold it permanently.

Under the microscope fiber dyed with any of the aniline colors shows a much greater uniformity in the levelness of the dyeing than obtains with indigo. Sections of the fiber seem to be uniformly colored all through the cell walls, and there is a comparative absence of surface coloring and the tendency to form detached masses of dye. Some fibers indeed seem to be perfectly dyed in every part, as though the mordant had penetrated every portion of the cell walls. This is true only of perfect fibers; unripe fibers naturally resist the color.

To make these refractory fibers receive the dye they have to be treated with strong alkali, "mercerized," which has the effect of thickening the cell walls and increasing their power of absorption. Mr. Bowman finds that such unripe fibers could also be made to receive aniline dyes by first bleaching them or by boiling them for a time in a weak solution of alkali. This increased capacity for dyeing, he thinks, may arise from the removal of waxy matter from the outer layer, or else from the opening of the pores of the fiber, although the same treatment seems to diminish the power of the tube wall to act as a dialyzer when treated with salts of alumina.

Alumina has a special interest in connection with cotton fiber, not only because of its peculiar property, when in its hydrated condition, of throwing down and heightening the brilliancy of many vegetable and animal coloring matters, but also because of its being separated from its various compounds by the dialytic action of the fiber alone, and thus retaining these coloring matters within the cell walls in an insoluble condition. Upon this action depends the process of dyeing Turkey red, one of the most stable of all colors.

The manner in which coloring matters of this class are associated with different fibers—kempy, unripe, fully ripe, etc.—is admirably shown in Mr. Bowman's illustrations. After treatment with lake of alumina and madder the kempy fiber shows many parts quite uncolored. In the unripe, horny fiber the coloring matter is confined to a thin layer, which by the act of shrinking has separated into detached flakes distributed irregularly through the thin tube. The fully dyed fiber shows the accumulation of coloring matter in the interior of the tube. In the transverse sections of fiber some are faintly colored in spots; others show the dye collected in clots within the tube. The distribution of the dye in the cell walls is also irregular. Sometimes the dye lies in layers; other fibers are uniformly tinted throughout; still others show an uncolored outer skin with a well dyed interior.

After considering at length the conditions of the fiber and the accidents of handling which interfere with the work of the dyer, Mr. Bowman expresses the opinion that increased efficiency in the coloring of yarn and fabrics must be looked for in the discovery of new preparatory processes which, like the strong alkali treatment, will increase the capacity of the fiber for receiving dye, especially imperfect and immature fibers, and also give to the mature fiber greater toughness and strength. Here would seem to be a promising field for investigation and invention. The wonderful change which occurs in the manufacture of parchment paper, by which the strength of the paper is increased eight or ten fold, indicates that there must lie within the reach of possible discovery a corresponding chemical process of strengthening cotton yarn while dyeing it, since both the paper and the yarn have the common basis, cellulose.

REPRODUCTION OF MEDALS, ETC.

There are several methods by which medals may be reproduced, and of these the following are the simplest and afford the most satisfactory results:

THE STEREOTYPE PROCESS.

The medal, thoroughly cleansed, dried, and coated with a thin but uniform film of pure sperm or olive oil, is bound around the edge with a piece of cardboard so as to form a box, the bottom of which is the medal. A small quantity of finest plaster of Paris is then mixed up quickly into a thin cream and applied all over the exposed surface of the medal with a camel's-hair pencil so as to fill all depressions and exclude air bubbles. A thicker cream of plaster is then at once poured in until the box is nearly or quite filled. When the plaster has properly hardened the cardboard is taken off, and the plaster adhering to the rim of the medal trimmed off with a knife; the medal can then be easily detached from the cast. Another cast may then be taken of the reverse side of the medal in a similar manner. These casts, after trimming, are set aside in a warm place until they become quite dry, and are then clamped securely, face upward, in a small shallow iron tray, so that their face is about half the thickness of the medal distant below the top or edge of the tray. The spaces in the tray about the casts are then filled up even with the inferior edge of the casts with plaster, *papier mâché*, or clay (dry). The tray thus arranged is put into an oven until the temperature of its contents is uniformly heated to about 250° Fah., when it is removed and immersed wholly below the surface of a potful of ordinary type metal heated just hot enough to make it quite liquid. As soon as air bubbles cease to escape the tray is slowly and steadily raised out of the pot, and the contents allowed to chill and harden in the air (sometimes it is preferable to plunge it in water, so as to facilitate the removal of the "cake" from the tray). When the plate of type metal is cut out of the tray a correct (reversed) copy of the plaster moulds will be found on its under surface, and when the superfluous metal has been cut away and the pieces trimmed to proper dimensions and thickness they may be soldered together back to back, and the edges cut, turned, or milled, as the case requires to produce a correct imitation of the original medal. Cleansed by dipping momentarily in a strong hot solution of caustic potash, and, after quickly rinsing in running water, in hydrochloric acid, it may be coated with silver or copper, if desired, by electro deposition.

BY ELECTROTYPY.

Melt pure white wax, and stir well into it while cooling about one-fifth its weight of finest flake white (plumbic carbonate). Having uniformly coated the faces of the medal with a film of finest graphite or plumbago, arrange it in the box of cardboard as in taking the plaster stereo cast, and pour in the wax preparation previously heated just enough to make it semi-fluid. Having thus obtained a mould in wax of both faces of the medal, harden the wax in a cool place, then coat it perfectly with a film of pure graphite, wrap about the edges a number of turns of clean copper wire, and brush on plumbago so that the film of the latter may have contact with the wax and wire all around. Suspend the wax cast thus prepared by the copper wire in a saturated (or nearly saturated) aqueous solution of *pure* sulphate of copper, jarring it so that all bubbles of air may escape from the deep lines of the cast. Close in front, but not touching the immersed mould (or its connections), suspend by a copper wire a sheet of clean copper. Connect the copper by stout copper wire with the silver (or carbon) pole of a Smee battery of three cells (in series), and the copper wire on the mould, in a similar manner, with the zinc pole of the same battery, and let the deposition of copper on the mould proceed until it becomes thick enough to separate without breaking (about as thick as this paper). Then carefully detach it from the mould, embed the pieces, face downward, in dry plaster, and fill up (after drying) with melted type metal (or fusible metal). Trim to proper size and thickness, solder the pieces together, back to back, and cut or mill the edges to proper form. These *copies* may be coated with a thin film of silver by electro deposit. The surfaces may be given an *aged* appearance by immersing them for a few moments in a dilute solution of sulphide of soda in warm water.

When a copy, as produced by stereotypy, of a medal is taken in metal, the latter coated with plumbago, and immersed in a bath composed of three-quarters of a pound of sulphate of nickel and ammonia per gallon of water, under the conditions described in electrotyping with copper, a hard shell of nickel is obtained, which, when separated and backed with type metal, may be used as a die. It is difficult, however, for an amateur in electro-metallurgy to obtain good results in this way. Steel dies cannot be produced in this way. Moulds for stereo or ordinary casting should be heated.

For a fusible silver-white alloy melt type metal and mix it with one-eighth its weight of grain tin, remove from the fire, and stir well before pouring.

Proposed Exhibition in Boston.

After several months' inquiry the committee appointed to investigate the feasibility of holding a World's Fair in Boston have reported in favor of the enterprise, provided $5,000,000 can be secured. The property known as Beacon Park has been offered as a site for the fair free of rental.

PORTABLE PNEUMATIC RIVETING MACHINE.

The old-time way of riveting boiler shells and similar work is fast giving way to the more scientific and economical method of doing it by machinery. Our engraving shows one of the simplest and best machines for this purpose. It is operated by compressed air, and is capable of driving rivets as rapidly and effectively as the larger and more expensive steam or hydraulic riveters now in use. Its operation imitates handwork, but the results are superior to handwork.

Fig. 1 shows the riveter operating on the side of a boiler shell. It is supported in a ring, so that it may be turned to any angle or work in any desired position. The hammer is brought into contact with the rivet head by a rapidly reciprocating piston working in the air cylinder, and the anvil is brought up to its work by the air cylinder between the shorter arms of the levers.

The long arms of the levers are made 63 and 76 inches from center of joint pin to the center of riveter, capable of reaching a rivet 60 or 72 inches respectively from the edge of the plate, so as to operate upon the circular seams of a boiler. The levers are turned in the ring by a worm-wheel to place the machine at any desired angle.

The valve of the riveter is operated directly by the pressure in the cylinder without extra gearing, and so arranged that the length of the stroke regulates itself automatically to correspond with the gradual reduction of the end of the rivet as the head is formed.

The machine is operated with an atmospheric pressure of from 20 to 30 pounds to the square inch, and makes from 150 to 200 strokes per minute. The time required to form the head of a three-quarter inch rivet is about six seconds, and at steady, straight work, allowing for ordinary detention and loss of time, two rivets can readily be finished in one minute.

The machine may be suspended from a bar arranged overhead to allow a longitudinal motion to the riveter when operating on straight seams, but a traveling carriage, capable of a longitudinal and side motion, is preferable, so that when operating against the side of the boiler shell, as shown in Fig. 1 (which is found to be the most convenient way of operating with the machine), the machine can easily be regulated for any diameter of shell.

Among the many advantages claimed for this riveter are its lightness and portability, its rapidity of action, and the great saving of labor in handling the work, beside turning out a better quality of work than can be done by hand.

This machine is one of the objects of interest at the present fair of the American Institute.

Further particulars in regard to this machine may be obtained by addressing Mr. Henry E. Raeder, 304 Broadway, New York city.

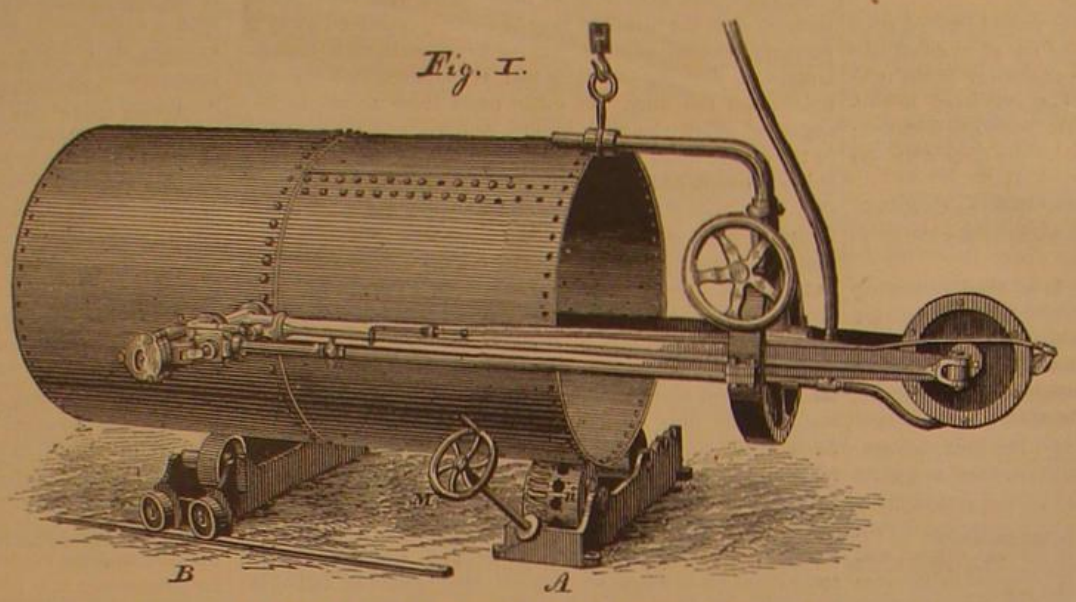


Fig. I.

ALLEN'S PNEUMATIC RIVETING MACHINE.

American Institute Exhibition Notes.

Persons who have annually visited the exhibitions of the American Institute have sometimes complained of sameness, but even to the most casual sightseer who may have had occasion to thus complain the exhibition now open at Sixty-third street and Third avenue must be an agreeable exception. The introduction of nearly one hundred Brush electric lights make night as bright as day, and give colors their real shades. Two powerful steam engines are now driving six large Brush dynamo machines at the rate of about 800 revolutions per minute, and their glory is divided among the hundred lights in and about this large building.

This is the fiftieth exhibition given by this Institute, its first having been in 1828, and annually repeated each autumn, except four, since that year. It would be interesting to canvass the difference in the aspect of the world of science and art then and now. The fifty glimpses of it that these exhibitions have afforded would be a fair panorama of progress in most branches of industry, but space is not now available for even a sketch of the improvements that have appeared during these fifty-four years. It may be safely said that no like period has been correspondingly marked, as the age of improvement in arts and sciences. It is the age of steam, of steel, and of electricity.

To the careful and the special observers from year to year these exhibitions have shown the successive steps in the grand march of improvement in mechanical industries. Each exhibitor has made some improvement in his specialties, either as to quality of products or facility in producing. From the fireman in his grim attire and with his simple tools, who furnishes the prime force, through all the types of machines that his product moves, and the delicate as well as ponderous products of these machines to the æsthetic and beautiful you may learn the little story of recent technical progress from each.

Among the giants of the exhibition that overcome nature's solider work, destroying instanter the cohesion that for ages upon ages has held the solid rocks in form, is the crushing machine, which will give you a noisy proof of its ability to disintegrate one hundred tons in ten hours of blue stone, granite, or quartz. It is the celebrated Blake challenge rock breaker, gnashing 275 times per minute at its uncanny mouthful of "hardtack." It is manufactured by the well-known Blake Crusher Company, of New Haven, Conn.

The Delamater Iron Works, No. 10 Cortlandt street and West Thirteenth street, N. Y., are exhibiting a fine lot of Ericsson's new caloric pumping engines for domestic use in lifting and forcing water from wells and cisterns, or from Croton pipes to tanks on upper floors of buildings in city or country. They can be operated and attended by any one who can use a cooking stove, and they are as free from dangerous vices as the simplest utensil of the kitchen. They vary in capacity from 200 to 1,600 gallons of water raised to a height of 50 feet.

A sample of the new Otto silent gas machine built by Schleicher, Schumm & Co., 3045 Chestnut street, Philadelphia, is exhibited by their New York agent, A. C. Manning, of 38 Dey street. This engine burns common illuminating gas mingled with common air, and is always ready to start by applying a lighted match. It has lately been much improved, and on account of its cleanliness and safety it is popular as a motor for small power in offices and dwellings.

The Hartford Engineering Company, of Hartford, Conn., builders of the Hartford high speed steam engine, have on exhibition, besides a sample of their engine that drives four of the Brush dynamo machines, a full line of the celebrated Medart belt pulleys. They are made with cast iron spiders or centers and arms, and wrought iron rims, which are riveted to properly formed T-ends of the arms. They are an agreeable departure in mill work, being light and strong, as well as the cheapest pulleys now offered.

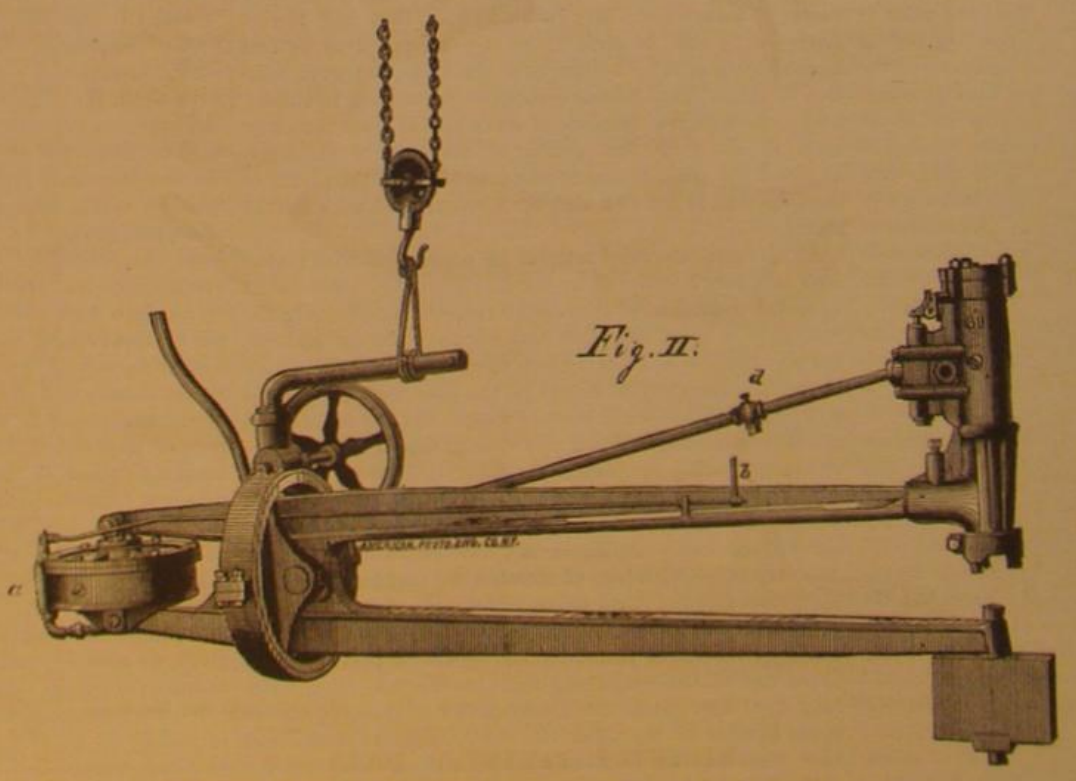


Fig. II.

PNEUMATIC RIVETING MACHINE.—SIDE ELEVATION.

Vulcanized rubber fabrics for all mechanical purposes are shown in full line by the New York Belting and Packing Company, the oldest and largest manufacturers in this country. They also exhibit fine specimens of rubber-lined cotton fire hose, which receives in the course of its manufacture a vaporous carbolic acid treatment to prevent mildew and rot, to which all cotton goods exposed to wet and dry are otherwise liable. It is known as "cable hose," and is circular wove and therefore seamless. It will stand extraordinary and long-continued internal strain without bursting. Notable among these exhibits are three immense grain elevator belts. One pair called the "Twin Giants" are 36 inches wide, 275 feet long, and weigh 2,800 pounds. A third and still wider is 48 inches wide and 200 feet long, weighing 1,800 pounds. Every variety of vulcanized rubber goods, including the well-known vulcanite emery wheels, can be found at their warehouse, 37 and 38 Park Row, New York.

The Lambertsville Iron Works are driving the two remaining Brush dynamo machines with one of their improved steam engines, 12 x 18, making 116 revolutions per minute. This engine is built upon the new plan of overhanging cylinder with heavy bed, has a new style of balanced slide valve and automatic cut-off valve actuated by a common centrifugal governor. It appears to fill the bill of a first-class high speed engine at a moderate cost. Their works are at Lambertsville, N. J.

Asbestos has now been put to a great variety of uses, both mechanical and ornamental. It is used for all kinds of non-conducting and fire proof coverings of roofs as well as boilers, steam packing and gaskets of all styles, lining felts and sheathings, paints and cements. These goods have proved a boon to steam users. All varieties of these articles, as well as the raw and partly manufactured material, are displayed by the pioneer and leader in asbestos goods, H. W. Johns, of H. W. Johns Manufacturing Company, 87 Maiden lane, New York.

The usual fine display of sewing machines is made by E. Remington & Sons, who exhibit their new Remington variety made at Ilion, N. Y., while their type-writer is made at Ilion, Ill.

Successful Moving of a Large Hotel.

At a recent meeting of the Engineers' Club, of Philadelphia, the secretary read a detailed description of the moving of the Hotel Pelham, at Tremont and Boylston streets, Boston, for the purpose of widening Tremont street. This hotel is built of freestone and brick, 96 and 69 feet frontage. The Boylston street wall is supported on eight granite columns 12 feet high, 3 and 4 feet square. There is a basement and seven stories above the sidewalk. Height above tramways on which it was moved, 96 feet. Weight, 5,000 tons, exclusive of furniture, which was not disturbed during removal, as also were not the occupants of the stores on first floor and some of the rooms, the various pipe connections being kept up with flexible tubes. Careful experiments with models showed that if the lower part of the building was firmly braced, there was no danger of shifting in the parts above. The general arrangements consisted of heavy and substantial stone and brick foundations for iron rails and rollers, and the building was forced to its new position by fifty-six screws, 2 inches diameter, half inch pitch, operated by hand against timbers arranged to uniformly distribute the pressure against the building. Much care and ingenuity was displayed in the details of the arrangements and work. Two months and twenty days were occupied in preparation. The moving itself was begun on August 21, and finished on August 25, but the actual time of moving was but 13 hours and 40 minutes. The greatest speed was two inches in four minutes. The hotel moved about one-eighth of an inch at each quarter turn of the screws. The whole distance moved was 13 feet 10 inches. Four thousand three hundred and fifty-one days' labor was required for the work. The whole cost was about $30,000. This is the largest building that has ever been removed, although larger have been raised, which latter is a much simpler and less risky operation. The complete success of this undertaking is shown by the fact that cracks which existed in the walls prior to removal were not changed by the operation. Paper was pasted over them before commencing, that any change might be seen.

ENGINEERING INVENTIONS.

A novel means for raising water from a well, cistern, or other receptacle, and conveying it to a distance and there discharging it, has been patented by Mr. James C. Richardson, of Boscobel, Wis. A wire track, inclining upwardly, is extended from the curb of the well, etc., to the place of discharge, and on this track a carriage, controlled by a rope and windlass, is arranged to run. Connected with this carriage by spring bolts is a bucket carrier, which, on reaching the well, is automatically released, to allow for the descent and filling of the bucket, after which the bucket carrier is raised by the rope and made to automatically engage with the carriage, that is drawn up the track till the bucket meets with a tilting stop, which causes the water to be discharged.

A firing and tamping device for torpedoes, more particularly intended for use in oil wells, but also applicable to wells and drills of various kinds, has been patented by Mr. James E. Gallagher, of Olean, N. Y. The invention consists of a weight designed to be dropped upon the head of the torpedo in the well or drill. This weight consists of a shell of fragile and insoluble material, filled with sand and provided with a solid point, which, striking the head of the torpedo, explodes the latter and causes the sand, that by the explosion and destruction of the shell of the weight is liberated, to be retained in a compact mass above the exploding torpedo, thus tamping the charge and causing it to act laterally.

Mr. James Hays Hagan, of Greenfield, Tenn., has patented an improvement in direct acting engines, in which three pistons are made to reciprocate in a single open-ended cylinder, and are connected with opposite cranks of a double crank shaft.

NEW TOOLS.

Among patents recently issued we find a few tools possessing some points of novelty. The pipe tongs, shown in Fig. 1, are the invention of Mr. N. Purdy, of Fall Brook, Pa. The improvement consists in linking the jaws of the tongs together at their outer ends, and linking one of the jaws permanently to the end of the handle or lever, the other jaw being adapted to be connected to the lever so as to grasp upon the pipe by means of a loop or similar device hinged or pivoted upon the end of the lever, and adapted to be placed over the end of the jaw.

The wrench shown in Fig. 2 has been patented by Mr. W. E. Wild, of Lead City, Dakota Territory. In this wrench the socket is provided with an interior adjustable section for adapting the socket to nuts of different sizes. The movable portion is provided with a rack which is engaged by a worm pivoted at the end of the handle.

An improved expanding mandrel that will hold the work firmly and truly, even under great pressure of the tool, is shown in Fig. 3. The invention consists of a longitudinally ribbed and split sleeve, which is driven into the work and on to a tapered mandrel. This improvement has been patented by Mr. J. A. Wilde, of Hudson, N. Y.

The improved lace cutter, shown in Fig. 4, is the invention of Mr. H. L. Chapman, of Marcellus, Mich. The invention consists in a slotted or split handle having the cutter fastened to its outer end in such a manner that the cutting edge crosses the slot diagonally. Through the slot an adjustable gauge for regulating the width of the lace passes, and can be locked in any desired position by means of the binding screw.

Fig. 5 represents an instrument for opening oysters, clams, and other shell-fish. It consists essentially in a sliding bar actuated by a lever handle and carrying an opening point or knife. An adjustable slotted standard is placed opposite the knife for supporting the oyster or clam. This invention has been patented by Mr. A. Ward, of Brooklyn, N. Y.

Fig. 1.

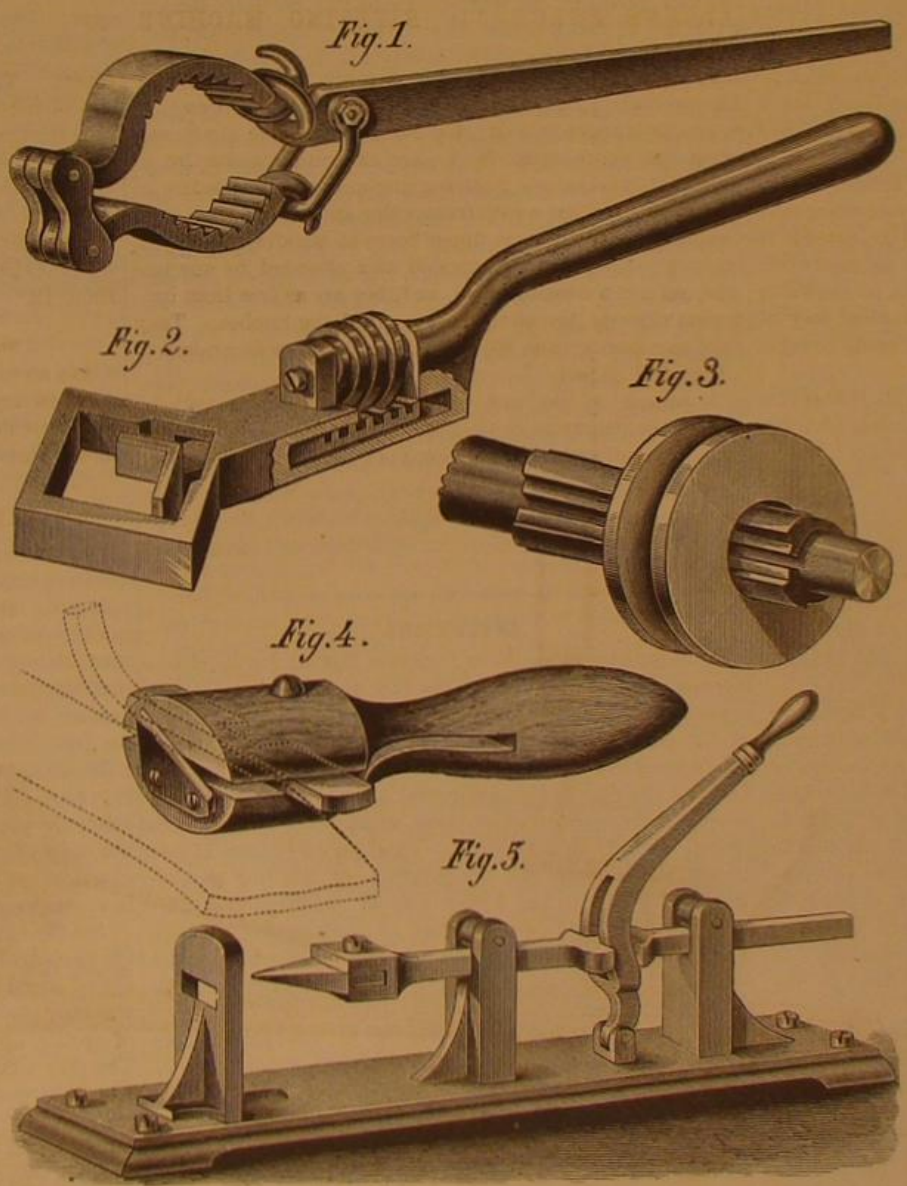


Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 1. Purdy's Pipe Tongs.—Fig. 2. Wild's Socket Wrench.—Fig. 3. Wilde's Expanding Mandrel.—Fig. 4. Chapman's Lace Cutter.—Fig. 5. Ward's Oyster Opener.

Fine Drilling.

Professor Edward C. Pickering, of Harvard College, says that in undertaking to measure the intensity of the light of the satellites of Mars he had occasion to need an extremely small hole. Among the artisans who essayed to furnish what was required was one who had succeeded in making a hole edgewise through an old-fashioned three cent piece, and another who had pierced a needle through from end to end. A hole about the twenty-five-hundredth part of an inch in diameter was finally secured.

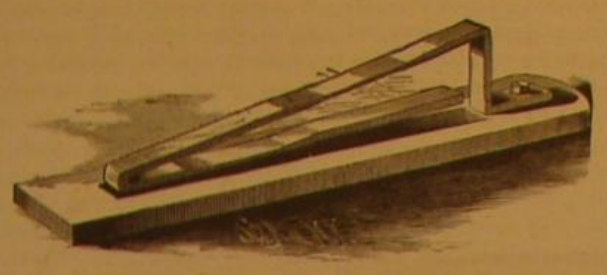
New Use for Buffalo Skins.

An inventor proposes to make machine gear wheels of raw buffalo hide by cementing and pressing together as many layers as are required for the breadth of the wheel. The blanks thus prepared are cut to form the teeth in the usual manner with suitable tools. The advantages claimed are, smooth and noiseless action at very high speeds and greater durability without lubrication.

NEW ORGAN REED.

The engraving shows a double-tongued reed for producing tones in unison or at an interval of an octave or more. The reed block has the usual slot.

The two tongues of this reed are formed of a single strip of metal bent double. One tongue is attached at one end to the reed block, and is raised above the block to give space for vibration of the other tongue beneath. The auxiliary tongue may be a separate piece of metal attached by a rivet.



DOWLING'S IMPROVED ORGAN REED.

The two tongues can be tuned to unison, or the upper reed may be tuned one or two octaves lower than the lower one. The combined tone is much more powerful than a single reed, and of superior quality.

This is the invention of Mr. John P. Dowling, of New Philadelphia, Ohio.

RECENT INVENTIONS.

An improved folding wardrobe bed has been patented by Mr. Ernest N. Doring, of New York city. This bed is so constructed that it will require less weight than heretofore to balance and keep in place. The invention consists in the combination, with the head boards and side boards, of curved friction bars pivoted at their lower ends and having their upper ends pressed forward by springs, whereby the pressure of the springs and curved bars against the ends of the sideboards will assist to keep the sideboards in any desired position.

Mr. George Derby, of New York city, has patented an improved mill burr which is in construction durable, and can be easily sharpened.

Mr. Thomas Aitken, of Pittston, Pa., has patented an improved coal drilling machine which is light, compact, and easily transportable, easy of adjustment, and will hold more securely in position for work.

An improvement in gong bells has been patented by Mr. Asa G. Golding, of New York city. The invention consists in constructing a gong bell with a handle attached to the bell, and having a neck, a shoulder, and a flange for suspending the bell detachably, a push rod having its lower end bent to one side, a bell clapper supported from a suspended frame and having a ball and a concaved disk at its upper end and a loose head at its lower end, and a standard having a base and having the horizontal upper end slotted to receive the bell handle.

A very compact and efficient hot water generator has been patented by Mr. William W. Goodwin, of Philadelphia, Pa., the same forming a portable heater for use in heating water for bath tubs, basins, etc., as required, or for use in connection with a boiler, for maintaining a supply of hot water, either as a separate apparatus or in connection with gas cooking stoves and ranges. The invention consists in a closely wound water coil inclosed within a double cylindrical casing arranged so that the heated air passes lengthwise of the coil in both directions, and through the outer casing to the escape flue, whereby the heat is utilized to the greatest extent and the water in the coil is rapidly heated. It also consists in a combination with such heater of a hot water reservoir, with which the coil of the generator is connected.

A very useful and complete machine for cleaning, polishing, and assorting nuts, such as pecan nuts, walnuts, etc., has been patented by Mr. Rudolph C. Koerber, of Austin, Texas. In this machine the nuts to be treated are first fed into a cylinder in which is deposited a quantity of gravel, broken stones, or pulverized glass, etc., and the cylinder rotated. By this operation the shells or particles of shells are broken from the nuts, which are thus cleaned. The nuts are then passed into a series of rotating reticulated cylinders, by which they are polished and separated from the gravel, etc., used in cleaning them, and are subsequently delivered down an inclined sieve to a box, from which they are raised by an elevator on to a vibrating sieve, which separates the larger from the smaller nuts. Any number of sieves, both stationary and vibrating, chutes, and receivers, are used to effect a thorough cleansing and extended assortment, according to size, of the nuts.

An improved balance scale has been patented by Mr. Arthur V. Abbott, of Brooklyn, N. Y. In this balance a beam is sustained by one or more flexible metallic strips rigidly attached to the beam and their support.

An improved steam pressure regulator has been patented by Mr. Howell A. Cummins, of Conneaut, Ohio. The invention consists, in combination with a valved steam pipe leading from a boiler, of a lever connected with the valve stem, and weighted at one end with a ball and at the other end with an empty tank or box nearly balanced by the ball. A box or tank containing mercury is connected with the steam pipe outlet and with the lever tank or box by tubular connections, so that when there is an excess of steam pressure in the steam pipe outlet, steam therefrom will enter the mercury tank and force a portion of its contents into the lever tank, thereby drawing down the long end of the lever and closing or partly closing the valve and correspondingly cutting off the steam.

Mr. Ernest W. Noyes, of Bay City, Mich., has patented a spring attachment or boot to be attached to the knees of horses for giving style to the action and gait of the animal, and for increasing his speed, and which at the same time tends to assist the horse in lifting his feet from the ground.

An improved currycomb, patented by Mr. Carey A. Manker, of Red Oak, Iowa, consists in a novel construction of the comb and its handle and the frame and handle of the brush, and a novel mode of connecting the comb and brush, whereby they may be used either alternately or simultaneously, or may be disconnected so as to be used separately.

Mr. Eleazer Ainsworth, of Wilmington, Del., has patented an improved boiler and pipe covering, formed of a layer composed of a mixture of morocco shavings and clay, and two layers composed of a mixture of paper-mill refuse or wood-pulp mill refuse and clay and lime, the layers being held by the wire wrapping.

Mr. Edward B. Ives, of West Point, N.Y., has patented an improved photographic plate holder. The invention consists in a novel mode of constructing the holder by attaching together a number of layers of material.

A hand sawing machine, for cutting trees into logs or lengths, has been patented by Mr. Martin Kurtzeman, of Shelby, Ohio. In this machine the saw is operated by a vertically vibrating hand lever, which is connected with the one arm of a bent lever, the other arm of which is provided with a toothed segment. This segment, which works on a lower fulcrum in the frame, gears with a pinion above, the shaft of which operates a crank arm or lever that is pivoted at its lower end to a saw arm or handle. The forward end of this saw arm is slotted to receive the rear end of the saw blade, which is pivoted to the saw arm. The hand lever works up and down between adjustable rubber blocks, which relieve the lever of jar and start it on its return movement.

RECENTLY PATENTED TOOLS.

OUR GRAIN CROP AND ITS COMMERCIAL IMPORTANCE.

[*Continued from first page.*]

decade; in the preceding decades the gain was 66 and 60 per cent. Seven-tenths of the entire crop last year was produced in Illinois, Indiana, Ohio, Michigan, Minnesota, Iowa, California, Missouri, and Wisconsin. The products of these States were, in round numbers: Illinois, 51,000,000 bushels; Indiana, 47,000,000; Ohio, 46,000,000; Michigan, 35,500,000; Iowa, 31,000,000; California, 29,000,000; Missouri and Wisconsin, each 25,000,000. Pennsylvania followed with 19,500,000 bushels; Kansas, 17,000,000; Nebraska, 14,000,000; New York and Kentucky, each 11,500,000. The home consumption of wheat is about 300,000,000 bushels.

The great corn-growing States are: Illinois, 326,000,000 bushels; Iowa, 275,000,000; Mississippi, 200,000,000; Indiana, 115,000,000; Ohio, 112,000,000; Kansas, 106,000,000; Kentucky, 73,000,000; Nebraska, 66,000,000; Tennessee, 63,000,000. Far below in the scale of productions are the following, the figures standing for millions of bushels: Pennsylvania, 46; Wisconsin, 34; Michigan, 32; Virginia, 29; Texas, 29; North Carolina, 28; New York, 26; Alabama, 25½; Arkansas, 24; Georgia, 23; Mississippi, 21.

The oat crop comes mainly from Illinois, 63,000,000 bushels; Iowa, 50,500,000; New York, 37,500,000; Pennsylvania, 34,000,000; Wisconsin, 33,000,000; Ohio, 28,500,000; Minnesota, 23,500,000; Missouri, 21,000,000; Indiana, 15,500,000. Four-tenths of the area of this crop and nearly half the total product are accredited to the first four States named.

Of the barley crop California and New York produce nearly one-half, and Wisconsin, Iowa, and Minnesota yield most of the other half. About half the rye crop comes from Pennsylvania, Illinois, and New York. Of the buckwheat crop (about 12,000,000 bushels) two-thirds are produced by New York and Pennsylvania.

The enormous and wonderfully rapid increase in our grain crops is attributable to several causes. Primarily we have the invention and improvement of agricultural machinery, by which the cultivation of the great West has been made possible. Next we have the vast extension and improvement of our railway and water lines, making possible the profitable transportation of the large surplus to Eastern and foreign markets. With this extension of means has come an important lowering of freight charges, which has made it possible to place American grain in the markets of Europe at prices at which it can compete successfully with European grain, especially that from Russia, Hungary, Austria, and Germany.

Of course the vast immigration of farmers who have swarmed into the Northwest, a full regiment a day for every day in the year, is an element of the problem of no mean significance; but their labor has been largely invited and made profitable by the cheapening of the transportation of their crops to the East and to Europe.

Ten years ago it was the belief of railroad men that grain could not be carried from Chicago to New York for less than 24 cents a bushel. The rate has since been lowered to 20 cents, and for special rates, it is said, on good authority, to half that sum. The nominal rate at this time is 17 cents. During the same period the cost of water carriage has been correspondingly reduced. The lowest estimate that we have seen of the actual cost of bringing wheat from Chicago to Buffalo by steam barge is $2.85 a hundred bushels; from Buffalo to New York by canal and river, $5.70; making the cost from Chicago to New York by water (all charges included), 8⅝ cents a bushel.

Ten years ago it cost nearly as much to get a bushel of grain from Buffalo to New York as it now does to carry it from Chicago to Liverpool. The influence of a reduction of a cent a bushel in transportation charges would be incredible if we did not know how narrow is the margin of profit in the handling of great staples. The reduction of one cent in the Erie Canal tolls was followed by an increase in grain carriage from 29,000,000 bushels to 69,000,000 of bushels. In a recent Legislative inquiry a prominent grain merchant expressed the belief that the abolition of the remaining one cent toll would increase the flow of grain through the canal to 150,000,000 bushels a year.

Something over half of the entire export grain trade of the country is done at this port, where the elevators and great warehouses have a storing capacity of nearly twenty-five million bushels. A very large part of the grain passing through the city, however, is loaded directly from the canal boats into the ocean steamers, as shown in our illustration. Commonly the loading and unloading go on together, a floating elevator hauling alongside and pouring in the grain as fast as the outgoing freight is removed. Usually the canal boats carry from five to seven thousand bushels or more, four of them sufficing to load a grain ship, and eight to ten a large steamer. The largest cargo ever brought through the canal was recently reported; it was 8,500 bushels. The largest grain steamer will carry 150,000 bushels; from 80,000 to 90,000 bushels is a large cargo.

To carry our entire grain crop would require from thirty to fifty thousand large steamers; or something like half a million canal boats, or a train of freight cars over thirty thousand miles long! To carry away as wheat our exports of wheat and flour would require five thousand vessels carrying the average cargo of 30,000 bushels each. It is only by figures like these that one can make any approach to a definite idea of the magnitude of the grain trade, or its enormous influence upon the world's commerce.

Though not intended specially for the grain trade, the huge steamer, the City of Rome, shown at the bottom of our first page illustration, will, no doubt, prove an important factor in its future development. This steamer ranks next to the Great Eastern in size, and is the largest vessel in the merchant service. Her dimensions are as follows:

Length of keel, 546 feet; length over all, 590 feet; breadth of beam, 52 feet; depth of hold, 38 feet 9 inches; and depth from top of deck house to keel, 52 feet. Her tonnage is 8,300, being over four-fifths that of the Great Eastern. The leading particulars of the engines are as follows:

There are three high pressure cylinders 43 inches in diameter, and three low pressure cylinders 86 inches in diameter, and 6 feet stroke. The diameter of the crank shaft is 25 inches, and of the crank pins, 26 inches. The length of the main bearings is 33½ inches, and of the crank pins 28 inches. The crank shaft, as built up complete, will weigh 64 tons; had it been made of iron, and solid, the weight would have been 73 tons. The propeller shafting is 24 inches in diameter, and the hole through it 14 inches in diameter. The thrust shaft has thirteen collars 39½ inches in diameter, giving a surface of 6,000 square inches. This piece of shafting weighs 17 tons. The propeller shaft is 25 inches in diameter and 30½ feet long, and weighs 18 tons. The engine bed plate weighs 100 tons. The cooling surface of the condensers is 17,000 square feet, equal to nearly 17 miles 360 yards of tubing.

There are two air pumps 39 inches in diameter, and 3 feet stroke; these pumps, and the feed and bilge pumps, being worked by levers attached to the aft and forward engines. There will also be a large centrifugal pumping engine, which can either be used for pumping heavy leaks, or to discharge through the condenser. There will also be three auxiliary pumping engines, for feeding the boilers, for bilge pumping, and for deck purposes. Steam will be supplied by eight cylindrical tubular boilers, fired from both ends. Each boiler is 14 feet mean diameter and 19 feet long, with a steam receiver 13 feet long and 4 feet in diameter, and has six furnaces 3 feet 9 inches in diameter, three at each end, so that there are forty-eight furnaces in all. The fire bars are 6 feet long, giving a grate surface of 1,080 square feet. The shell plates of the boilers, supplied by Sir John Brown & Co., are 24 feet 8 inches long, 4 feet 4½ inches wide, and 1¼ inches thick, and weigh nearly 2½ tons each; all the holes are drilled. The internal parts are of Bowling iron, and each furnace has its own separate combustion chamber. These boilers are constructed for a working pressure of 90 pounds per square inch. The engines are intended to work constantly at 8,000 indicated horse power, although they are capable of developing 10,000 indicated horse power.

Though built for a speed of over 17 knots an hour, or over 400 miles a day, the maiden trip of the great steamer was a slow one. Three stoppages of importance were necessary during the voyage, owing to the machinery. On the first night out from Queenstown the journals grew too hot to continue, and a two hours' stop was necessitated. On the following day the reversing gear of the engine got out of order, and for sixteen hours the monster vessel lay to in a rough sea, rolling heavily. Afterward the steam steering gear became deranged, and two hours more were lost while the engineers worked at it. Stoppages excluded, the voyage across the Atlantic was made in eight days and twenty-two hours.

INVENTIONS.

An improvement in boiler furnaces, having for its object the complete combustion of the fuel and gases in the fire boxes of steam boilers, evaporators, etc., has been patented by Mr. John Mailer, of San Francisco, Cal. The door of the furnace has a series of air passages through it, and the lining of the door is also made with a series of perforations, in which are inserted short stout metal tubes that project inward toward the door front. These tubes become highly heated and elevate the temperature of the air passing through the door. The bridge wall of the furnace is likewise provided with several rows of perforations, through which the smoke and gaseous products of combustion are restricted in their passage from the fire chamber to the combustion chamber.

Mr. John H. Blake, of Batavia, N. Y., has patented an improved cut off valve gear. The invention consists of two slide valves, one at each end of the cylinder, each having a separate steam chest, into which steam is admitted throughout the whole stroke of the engine, the point of cut-off being regulated by rotary valves that are placed in supplemental steam chests over each slide valve; and it consists, further, of a hydraulic cylinder designed to be operated by water under pressure, provided with suitable valve and piston, which cylinder forms the connection between the governor and rotary or cut-off valves, and facilitates and regulates the action of the latter. The mechanism for operating the valves and the rotary valves are of peculiar construction, and among the advantages attained by this system of governing are the retention of the cut-off at any point it may have assumed, the slight strain thrown upon the governor, great sensitiveness of the latter, and nicety of adjustment to any point of cut-off desired, also the prompt and decided action of the cut-off devices.

Mr. Adam R. Reese, of Phillipsburg, N. J., has patented a machine for quarrying slate and other rock. The object of this invention is to avoid that excessive waste of the rock, labor, and expense which is attendant upon the ordinary methods of quarrying, by the use of an improved machine for sawing and cutting the rock *in situ*. This machine is provided with a reciprocating traveling carriage having rotary saws or cutters for effecting the cut of the rock. The carriage is supported on a frame furnished with vertical screw threaded and sharp pointed legs for the purpose of adjusting the frame to different inclinations or levels. Screw adjustments also are provided for shallow or deep cutting by the saws. The machine is organized for cutting parallel channels in the slate or rock, and the saw teeth cut upward, so that the power applied to the cutting shall operate to hold the machine more firmly down in position. An engine is mounted on the frame for operating the mechanism which transmits the necessary motion to the saws, but it is designed that the motive agent, which may be steam, compressed air, or gas, shall be furnished by suitable metal pipes and flexible tubes from a source which is independent of the machine.

Mr. William Crye, of Walla Walla, Washington Territory, has patented an improvement in middlings purifiers. The object of this invention is to keep free and clean the screens of middlings purifiers used in the process of manufacturing flour. To this end, the screen of the purifier has combined with it a reciprocating brush frame, the brushes of which act upon the underside of the screen. A rotating double-threaded rod, working in a double-threaded nut, gives the necessary reciprocating action to the brush frame, the nut being tilted at the end of each stroke for the purpose of engaging and disengaging alternately with the right and left hand threads on the rod.

Mr. Richard H. Atwell, of Baltimore, Md., has patented a spray motor, which is not restricted to a mere construction of parts, but includes a valuable principle of action. The invention consists in a method of increasing the effective power of rotary jet motors by commingling a gaseous and liquid medium to form a spray, and directing this spray against the periphery of a wheel or moving interior portion of the motor. Various kinds of gas may be used in concert with water to form the spray, and either the gas or liquid be energized. In either case it is claimed that a greatly increased result is obtained over or as compared with the use of air or gas alone or a liquid alone as the impelling agent. The invention also consists in certain constructions of different parts of a rotary jet motor for advantageously carrying the above principle into effect, the same including an inlet for a liquid medium and an inlet for a gaseous medium having a confluence at or before the point of impact against the wheel; also a wheel against which the spray acts formed of a disk with angular buckets projecting from the side of the same.

Mr. James D. McAnally, of Waterloo, Ind., has patented an improved harness catch and cockeye for whiffletrees, etc. This invention, which is equally adapted for use upon neck yokes, bridle bits, water hooks, and in fact upon all parts of a harness where catches are desired, consists in a ferrule having an outwardly or endwardly opening catch, clipped away on its under side, in combination with a vertically inserted cockeye, capable of ready engagement and disengagement, and having its pintle protected from dust.

The Longevity of the Ancients.

Can man reach and pass the age of a hundred years? is a question concerning which physiologists have different opinions. Buffon was the first one in France to raise the question of the extreme limit of human life. In his opinion, man, becoming adult at sixteen, ought to live to six times that age, or to ninety-six years. Having been called upon to account for the phenomenal ages attributed by the Bible to the patriarchs, he risked the following as an explanation: "Before the flood the earth was less solid, less compact than it is now. The law of gravitation had acted for only a little time; the productions of the globe had less consistency, and the body of man, being more supple, was more susceptible of extension. Being able to grow for a longer time, it should, in consequence, live for a longer time than now."

The German Heusler has suggested on the same point that the ancients did not divide time as we do. Previous to the age of Abraham the year, among some people of the East, was only three months, or a season; so that they had a year of spring, one of summer, one of fall, and one of winter. The year was extended so as to consist of eight months after Abraham, and of twelve months after Joseph. Voltaire rejected the longevity assigned to the patriarchs of the Bible, but accepted without question the stories of the great ages attained by some men in India, where, he says, "it is not rare to see old men of one hundred and twenty years." The eminent French physiologist, Flourens, fixing the complete development of man at twenty years, teaches that he should live five times as long as it takes him to become an adult. According to this author the moment of a completed development may be recognized by the fact of the junction of the bones with their apophyses. This junction takes place in horses at five years, and the horse does not live beyond twenty-five years; with the ox, at four years, and it does not live over twenty years; with the cat at eighteen months, and that animal rarely lives over ten years. With man it is effected at twenty years, and he only exceptionally lives beyond one hundred years. The same physiologist admits, however, that human life may be exceptionally prolonged under certain conditions of comfort, sobriety, freedom from care, regularity of habits, and observance of the rules of hygiene, and he terminates his interesting study of the last point ("De la Longévité Humaine") with the aphorism, "Man kills himself rather than dies."—*M. De Solaville, Popular Science Monthly.*

Correspondence.

Small Motor Wanted.

To the Editor of the Scientific American:

It is a marvel that no one has as yet invented a moderately sized machine for working punkas in India. Each room in three-fourths of the stations of this country has its punka worked by a cooly, and the annual cost of these men, whose pay varies from three to six rupees ($1.50 to $3) a month, is enormous. In large establishments, such as barracks, of course, very many are required, but in private houses, too, they may often be counted by the dozen.

Not only are they very expensive, but they are at the same time, in nine cases out of ten, very useless, and many are the sleepless nights passed by the hapless European, due solely to the cooly, whom it is impossible to keep awake. The moment the punka stops, not only does the heat become oppressive, but bloodthirsty mosquitoes in myriads swoop down on the unfortunate victim. He then, who would invent a simple machine to work a punka that could be regulated by the owner himself and render him independent of the drowsy cooly, would not only confer an unspeakable blessing on the Anglo-Indian community, but would also make an enormous fortune commercially, for once let their value be known they could not be made quickly enough.

In some barracks and hospitals there are already punkas worked by steam, but it is not these we want; it is a common, simple machine that could, if necessary, be moved from room to room. As the resistance offered by a small punka is very slight, it would require no very powerful mechanical contrivance to work one for eight hours, say, before it required fresh adjustment.

If you will publish this far and wide through your valuable columns, it may lead to some invention that will at once secure a fortune to the inventor and prove an inestimable boon to the sufferers who are dependent upon drowsy, frail, human machines for their comfort and repose.

F. W. MAJOR.

Calcutta, September 5, 1881.

REMARKS.—A machine such as our correspondent describes is wanted almost everywhere. Its invention would be of great value. We will offer a few suggestions to those who may wish to study the subject. The punka referred to consists of a large fan suspended from the ceiling of the apartment and operated by a rod which the attendant pushes back and forth. To work a punka so as to produce a sensible effect in the hot climate of Calcutta requires the exercise of a force equal to about one-tenth of a horse power. To the majority of people it looks as if this small force might be easily applied by a coiled spring or a weight. Let us try the weight. How large a one is needed? For a full horse power a weight of 33,000 pounds descending one foot in a minute is required. To drive a punka, therefore, one-tenth of the above, that is, a weight of 3,300 pounds descending one foot, will do the business for one minute. To make it run ten minutes the weight must be wound up ten feet high, or six winds an hour. In the household so weighty a machine would be cumbersome. Springs would occupy less space, but they would still require to be pretty heavy and must be frequently wound. If our correspondent has gas he can readily obtain a small gas motor which, on a consumption of six cubic feet per hour, will drive one punka. Next to that probably the best motor would be water. A tank filled with water eleven feet square and same depth, placed twenty feet above ground, if allowed to discharge its contents in a suitable manner upon a small wheel at the ground, would drive a punka for eight hours. The water must then be pumped up again into the tank. There is no royal way to realize mechanical power. It is simply the lifting of a dead weight, either by turning a wheel or working a pump, or carrying water upstairs in buckets, or using the power of the wind, running streams, or a combustion of fuel.

The Influence of Atmospheric Pressure on Earth Currents and Mine Gases.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of October 22, there was an article referring to some observations, which, if correct, establish the influence of atmospheric pressure on the flow of springs. This recalled to me a fact observed years ago, and which strikingly exhibits a consequence of an increase or decrease of this pressure that we do not usually think of.

I used to live in Switzerland. Years ago a gentleman of my acquaintance attempted to dig a well. The ground proved to be sand and gravel to a depth of 93 feet, when at last water was found. The well was walled in in the usual fashion and a force pump set in. But soon the water disappeared. The well was deepened again, until at a depth of 115 feet water was reached again. But as the nature of the soil continued the same this water also soon disappeared, and the well was therefore given up and covered over. Soon after a remarkable phenomenon was observed. At certain times a violent wind would blow from the well, so strong as to blow a handful of straw held over it eight or ten feet in the air. At other times the current would run in the opposite direction. Soon it was observed that a change of direction in the current of air would precede a change of weather: an upward current came to mean rain, a downward direction fair weather. The well was consulted a good deal by the neighboring farmers, especially in haying and harvest time, and proved a very sensitive barometer. Of course the explanation suggested itself at once. A decrease in the pressure of the atmosphere would release a great quantity of air pent up under the previous higher pressure in the extremely porous soil, for which this well proved a convenient drain. The opposite would take place under an increasing pressure, *i. e.*, during a rise of the barometer.

About a year ago or more, there appeared in the *Nineteenth Century* an article by Mr. Plimsoll, discussing the possibility of preventing explosions in the coal mines, an article which elicited several others on the same subject. In Mr. Plimsoll's article the well known fact was alluded to that during a low pressure of the atmosphere the air in the mines was much worse than when the barometer stood high. The cause of this is usually assumed to be a less free circulation of the air. Would not the above mentioned observation on the well suggest another cause—an enormously increased discharge of carbureted hydrogen gases under a lower atmospheric pressure?

The same thing must take place over very large areas every time when the barometer indicates low atmospheric pressure. A good deal of the air escaping from the ground must be miasmatic in its nature. Pettenkofer's investigations leave no doubt of this. Would not this account also, in some degree, for the rather languid feeling that is very prevalent whenever a low barometer prevails over a large area for any length of time? J. J. SCHOBINGER.

Chicago, October, 1881.

The Deadly Fly in Texas.

To the Editor of the Scientific American:

In your paper dated September 24, page 196, I was much interested in the report of a disease produced by a "deadly fly," the *Callinhora anthropophaga*, found by Conil in the Argentine Republic; and so similar in many particulars is the fly, the worm (larvæ), and the disease produced by it, as well also as its favorite habitat, to the similar, if not identical fly, the stock pest of our summer and fall months here, that I may be excused for sending you a hastily written report of a case which occurred in my practice, selected from among others treated only on account of a hidden pathological condition which it seems possible may have been revealed through the agency of the worm.

At the time the article was written no volume of reference was at hand, by which I could give the systematic name, and hence reported it from an unscientific standpoint, using the vulgar name, the one by which it is known here, "screw worm."

From the very great resemblance of the illustration in your paper to the Texas "screw worm" and also the parent fly, I am inclined to think they are identical.

My own impression is they are deposited prehatched, as they attain their full growth and size by the fourth or fifth day, which is probably three-eighths to half an inch in length instead of *five*-eighths, as mentioned in the report.

It is singular that they seem confined to the trans-Mississippi, and, I believe, south of the 34th or 35th parallel.

Accompanying this note I forward you the report mentioned. T. H. CLARK, M.D.

Reagan, Falls Co., Texas, October, 1881.

We have received the report mentioned by Dr. Clark. The account of the case that occurred in his practice in 1878 is very interesting, and corresponds closely with the description he refers to in our paper of September 24, concerning the Argentine fly. We think that there have been instances of loss of life in this city from the bites of a fly that hovers about the hides that come from Buenos Ayres.

Dr. Clark's report was published in the *Virginia Medical Monthly* for June, 1879.

Painting of Cement and Plaster.

Much difference of opinion prevails respecting the question of painting Portland cement, and we have seen work painted a few weeks after the cement has set, which has stood well. There is one point which has a great deal to do with the question of successful painting, namely, the absorbency and dryness of the brickwork itself. Many new walls, saturated with moisture, are cemented, and in this condition no paint can possibly stand if laid on too soon. It is a good and safe rule to enforce that Portland cement work should not be painted within a year of its completion, to allow it to dry thoroughly; but we are safe in saying the majority of new fronts are painted before they have been finished three months. A very desirable precaution seems to be to coat the work with linseed oil first.

The painting of plaster work requires the same care, and the lime works out in small bubbles, destroying the paint. In painting plaster, white lead and linseed oil, with a little drier, is recommended by one authority. This coat should be of the consistence of thin cream, so that the oil is absorbed into the plaster in a few hours. In a day or two another thicker coat may be applied, and a third a few days after rather thicker, followed by the finishing coat. Four coats are not too much for good work. By the absorption of the oil into the plaster the surface becomes hardened, and may be washed. Another method to facilitate this absorption is followed by painters, which is to give the plaster two or three coats of boiling linseed oil, and then to apply the other coats of paint. We are inclined to think the application of the oil before the paint a better plan, to insure a thorough saturation of the material. The color of Portland cement, and the uneven tints it sometimes assumes, is the main reason why painting it is resorted to. For this reason we think it may be worth the attention of manufacturers to turn their consideration to the subject, and those using cement as a stucco might also prevent a blotchy and uneven tint by attending to the preparation of the wall and the sand they use with the cement.—*Building News.*

AGRICULTURAL INVENTIONS.

Mr. Ashley E. Armstrong, of East Claridon, Ohio, has patented an improved conductor tube for grain drills and fertilizer distributers, so constructed that the plows can adjust themselves to uneven land, and can rise to pass obstructions without disarranging the tubes or interfering with their proper operation.

An improved stalk rake has been patented by Mr. Henry Grebe, of Omaha, Neb. This rake is intended for gathering cornstalks and other stalks and rubbish into windrows, to facilitate the preparation and cultivation of the land.

An improved sulky harrow has been patented by William Hannum, of Mount Gilead, Ohio. The invention consists of a harrow composed of two wings or sections hinged to each other, provided with guide rods and suspended from the axle, and three independent shafts journaled in standards secured to the axle, and provided with levers and eccentrics carrying chains secured at their lower ends to the harrow sections, near their outer and inner edges, whereby the central portion of the harrow or either harrow section can be raised or lowered independently of the other section to avoid obstructions, or both sections can be raised or lowered when desired.

An improved cornstalk loader has been patented by Mr. Peter C. Schlechtmann, of Arlington, Wis. This invention consists of a derrick of peculiar construction operated by a long lever and cords and pulleys.

A machine for splitting and breaking cornstalks has been patented by Messrs. Jacob Behringer, of Bowmansdale, William Stouffer, of Dillsburg, and Joseph R. Potts, of Mechanicsburg, Pa. In this machine the cornstalks to be operated on are passed in between a pair of feed rollers, to and over a stationary breaking bar, where they are first split by the action of a revolving winged cylinder of knives, and subsequently broken down across the edge of the bar by the wings or arms of the cylinder. The split and broken cornstalks can be handled by a fork with as much ease as hay and straw; they form better feed for cattle than when whole or merely cut crosswise; and the refuse stalks will be much sooner converted into manure.

A pulverizing attachment for plows has been patented by Mr. Tapley B. Maddux, of Denton, Texas. The object of this invention is to pulverize furrow slices as they are turned by plows; and it is particularly designed to lessen the draught in such devices by arranging the cutters at the top of the mould board in such manner as to offer but little resistance to the passage of the furrow slice. To this end the curved mould board of the plow has a bar secured to its upper curved edge, on which bar are fastened a series of cutters arranged to project upward and inclined or curved to the rearward, also formed with shoulders which rest upon the mould board. The cutters are sufficiently long to reach through the furrow slice.

Mr. Armand Richard, of Grand Coteau, La., has patented an improvement in plows, in which provision is made for adjusting the blade of the plow, as it wears, by loosening a clamp bolt and removing the teeth of a clamp from notches in a flange with which they engage, after which the blade may be set further forward. The clamp bolt does not pass through the cutting blade, consequently the latter is not weakened by a hole for the bolt.

The Panama Canal.—Work Done.

The president of the American Branch of the (De Lesseps) Panama Canal Company has issued a statement of the condition of the work. Notwithstanding the obstacles encountered in the luxuriant vegetation and the thick forests, there has been opened and recorded transversely to the axis of the canal over 200 kilometers of paths, and also a passage from 20 to 30 meters has been made from one end of the Isthmus to the other, according to the proposed lines of the Canal Commission. For meteorological studies, to which especial attention has been given, four stations have been established—at Colon, Gamboa, La Boca del Rio Grande, and Naos Island. Geological surveys have been made and are now in progress. It has been ascertained that between Colon and Lion Hill the canal will not encounter any rocks. At the present time two steam sounding apparatus are being put up similar to those at Colon. At this station the samples brought up by the spoons have given an exact structure of the soil. It is shown to be a succession of layers of clay, representing the degradations of a greenish pyroxenic rock, which through its gradual degradations and decomposition has produced this formation. At other places the ground, bored to a depth of 25 meters, has revealed nearly every way, instead of successive formations methodically arranged, a chain of derived rocks growing softer and softer. The thickness of the mellow soil is quite remarkable, and, in a word, the soundings have given results beyond expectation on the whole line of the canal.

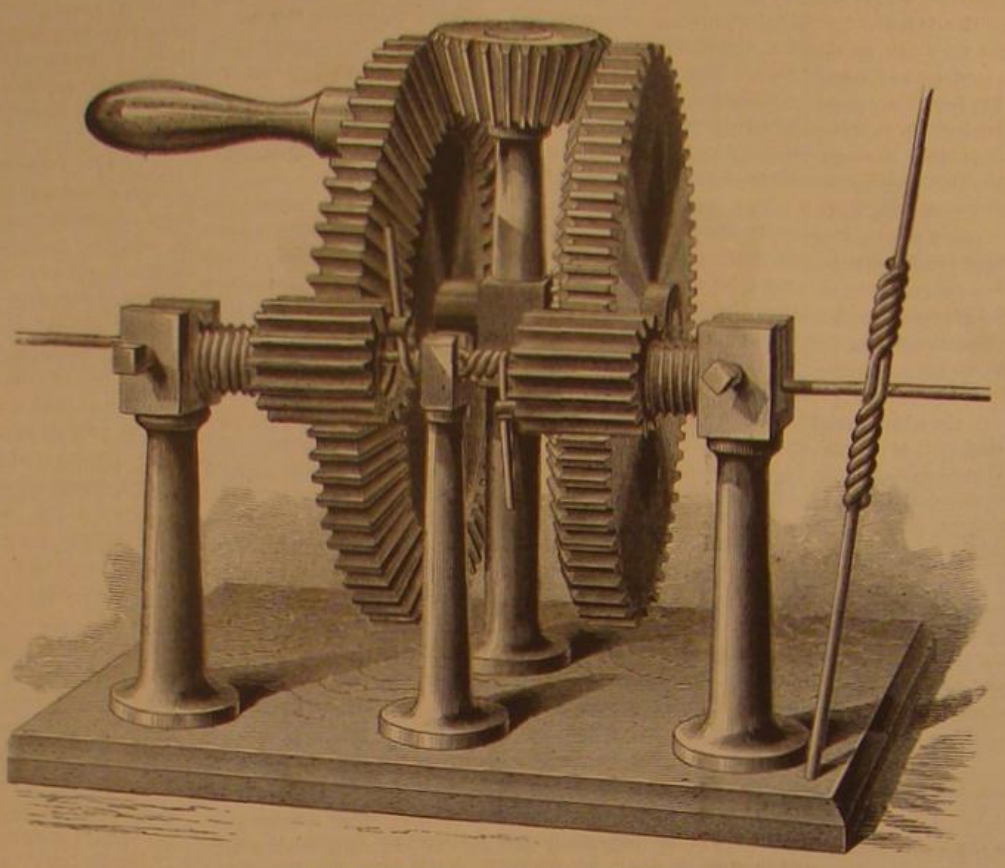
Work on the canal has been commenced. The company now have 200 cars, 12 locomotives, 2 pontons, 2 steam cranes, 18 flatboats, 2 dredges with change pieces, ribbon saws, rails, etc., a part of which is already at Colon and the remainder is on the way. The storehouses at Colon cover an area of 1,400 meters, and are full. Five barges and two steamboats are plying upon the Chagres River. Another steamboat at Panama is used for hydrographic surveys of the bay.

TELEGRAPH WIRE JOINTER.

The engraving shows a simple and compact machine for quickly joining the ends of telegraph wires. Two standards fixed opposite each other on the base support two horizontal screws extending inward toward each other. A groove, extending the whole length of each screw, is cut through its upper face as far as the axis for receiving the ends of the wires that are to be jointed. Upon each screw there is a pinion also slotted to admit the wire and provided with a stud on its inner end. These two pinions are engaged by two spur wheels turning loosely on the same axis and having beveled cogs formed on their adjoining faces.

The beveled portions of these wheels mesh into a bevel wheel supported on a bearing between them, so that when one wheel is revolved in one direction the other will move in the reverse direction. This results in turning the pinions in opposite directions and twisting the ends of the wire one around the other in opposite directions.

The wires to be jointed have their extremities bent at right angles. They are then laid in the slots of the screws through the slots of the pinions, which, acting as nuts, are run in opposite directions toward the standard. The bent end of each of the wires takes against the stud which projects from the inner end of the opposite pinion, and so that the wires overlap each other within a slot in the top of the standard placed between the two screws. The drive wheels are then turned by means of the handle, revolving the pinions in opposite directions, so that they move from each other. By this means the ends of the wires are twisted about each other in exact imitation of hand-jointing, as shown in the view of the section resting on the machine. This invention has been patented by Messrs. F. and J. A. Crich, the former of Johnstown, Pa., the latter of Naugatuck, Conn.

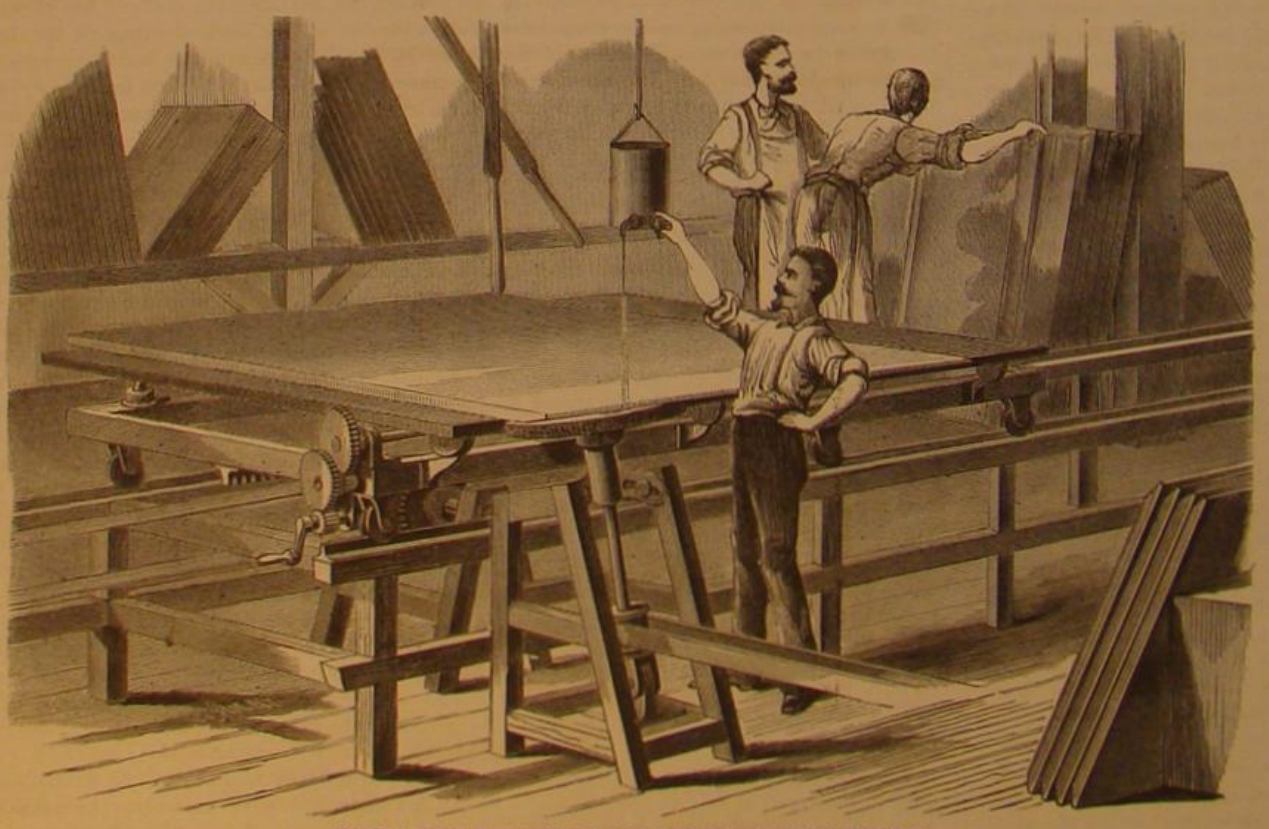


TELEGRAPH WIRE JOINTER.

PLATE-GLASS BEVELING MACHINE.

The engraving represents an improved machine for beveling and polishing the edges of plate glass. It is capable of making a bevel of any width or inclination, and it does it very rapidly and perfectly. The table upon which the glass plate to be beveled is placed, is supported upon a series of eccentric wheels mounted on a shaft passing along that edge of the table adjoining the grinding wheel. These eccentrics can be rotated gradually by means of geared wheels so as to raise or lower that edge of the table; the opposite edge of the table resting upon ball-and-socket joints. The grinding wheel of iron is mounted on a shaft which rests in a swiveled bearing which permits of the inclination of the shaft to the desired bevel.

The table on which the glass plate rests is movable lengthwise along a track which is double the length of the table. After placing the glass plate upon the table, the eccentric shaft is rotated until the longest radius of the eccentrics extend upward. The grinding wheel shaft is inclined more or less until the inclination of the wheel is the same as the angle of the desired bevel. If a very flat bevel is desired, the grinding wheel and its shaft are but slightly inclined; but if a steeper bevel is required, the inclination of the grinding wheel will be increased. The grinding-wheel having been adjusted, the power is applied, and the table-moving mechanism is made so that the motion of the table is reversed at the end of each trip of the table. The edge of the glass plate is drawn over the grinding disk, to which is applied the abrading or polishing material. After a certain time the edge of the plate will have been ground off to such an extent that the grinding wheel cannot attack or abrade it; the eccentric shaft is then rotated more or less, as may be necessary, adjusting the front edge of the table and of the glass plate resting on it, as may be required. This invention was recently patented by Mr. Dominique Durand, of Mamaroneck, N. Y.



DURAND'S PLATE-GLASS BEVELING MACHINE.

The Nature of Coal.

Messrs. C. F. Cross and E. J. Bevan have been carrying on a chemical research into the nature and method of the formation of coal. They treated jute fiber with sulphuric acid (sp. gr. 1·65) at 70°, and obtained an insoluble, black, spongy substance. This formation is in some way based on cellulose, as a similar compound may be formed from pure cellulose and dextrin. The production of this spongy substance is usually of a destructive character, attended with the evolution of carbonic acid and the formation of acetic acid. A study of the chemical properties of the substance has led the above-named observers to the conclusion that lignin is derived from cellulose by chemical modification. A remarkable circumstance in connection with the physical nature of the black substance in question is that it dries to a hard mass, resembling cannel coal, with which it has been compared, and similar results of chlorination and nitration have been obtained. This evidence goes in further support of the opinion that coal is not carbonaceous in any more special sense than alcohol, but is rather, as supposed by Balzer, composed of a series of C, O, H, N bodies, which are genetically if not homologously related. It is suggested that cellulose, lignin, peat, lignite, coal, and anthracite are terms of an infinite series specialized by the conditions of their formation.—*Jour. of Gas Lighting.*

NEW INVENTIONS.

An improved telegraph key has been patented by Mr. Addison E. Peterman, of Handsborough, Miss. This invention consists in a spring lever key of novel construction and arrangement, the object being to obtain uniform tension with ease in working, and to avoid the objections that exist to the use of a lever and separate spring.

Mr. George Andrews, of Bellows Falls, Vt., has patented an improved and durable belt to be used on all machines that employ narrow or round belts. The invention consists of a belt formed of a core of some strong material, preferably catgut, wound with strong wire.

Mr. Nicholas B. Dennys, of Singapore, Straits Settlements, British India, has patented an improved oil can tip. The object of this invention is to prevent waste from oil cans in oiling machinery; and the invention consists in a spring actuated tip applied to an oil can tube for closing the outlet.

An improvement in the manufacture of paper, patented by Messrs. Nicholas G. Richardson, of Tyaquin Monivea, County of Galway, and William Smith, of Golden Bridge Mills, county of Dublin, Ireland, consists in the employment of a new vegetable substance combined with other substances now used in the manufacture; or such vegetable substance can be used alone to make from it, by the aid of the usual appliances or apparatus, a pulp from which the paper is made. The vegetable substance used is *Molinea cærulea*, otherwise *Melica cærulea*, commonly known as "melic grass." This grass is converted into pulp or half-stuff, and the same can be, by the usual appliances or apparatus, converted into paper, or such substance as may be combined with any of the substances usually employed in the manufacture of paper.

Mr. Henry G. Dennis, of New Bedford, Mass., has patented an improved bell joint for coupling pipes. The invention consists in a rabbeted collar mounted on the end of a pipe and resting against an annular bead near the end of the same, which pipe is swaged out to receive the contracted end of the other pipe, upon which molten lead is poured through an aperture in the top of the collar to fill the space between the inner surface of the collar and the pipes, a clay roll having been previously placed against the open end of the collar.

An improved process of distilling alcohol has been patented by Mr. Charles W. Lawrence, of New York city. The process consists in charging the still with spirit-producing material and powdered charcoal in about the proportions set forth, then stirring and heating the mass by steam, as shown, whereby the operations of distilling and rectifying are accomplished at one operation, the empyreumatic oil being retained by the charcoal in the still.

Mr. Henry Wilson, of Stockton-on-Tees, County of Durham, England, has patented an improved apparatus for blowing, cooling, purifying, and otherwise attemperating air. This invention consists in certain novel features in the construction and arrangement of air pumps, suction and blowing engines, and devices combined therewith, for cooling, purifying, heating, and otherwise attemperating air or gas.

Mr. Patrick Shea, of South Boston, Mass., has patented an improved ironing board clamp, for securing an ironing board upon and above the top of an ordinary table, also in providing a support for the flat iron. The invention consists of a frame composed of two horizontal parallel bars, whose inner ends are respectively secured in the upper and lower edges of a block, which, with the bars, is designed to rest upon the table top to support the ironing board, said bars having their outer ends secured in the vertical slot of a head block that has a flange projecting inward at right angles from each end.

Mouth-pieces or holders for cigars and cigarettes have heretofore been made from glass by a moulding process, which leaves the articles thin at the mouth-place, where they are most liable to be broken. Mr. Adolph Demuth, of Brooklyn, N. Y., has patented a glass mouth-piece for cigars and cigarettes with an extra thickness of material at the mouth part, where most required.

MECHANICAL INVENTIONS.

Mr. Henry A. McLaughlin, of Karns City, Pa., has patented an automatic grain and liquid weighing scale. In this weighing scale a revolving wheel, provided with buckets and held stationary by spring catches for the reception in a bucket of the material to be weighed, is automatically dumped. Combined with the revolving bucket wheel is a pivoted delivery spout arranged beneath a hopper which supplies material to the wheel. This spout has a counterbalance arm or weight which serves to adjust it into a non-delivering position as the bucket wheel attached to the rack of the scale commences to sink by the weight of material in a bucket. A spring also acts upon the spout in a like direction. The ascent of the dumped wheel and its attached rack adjusts said spout into a delivering position. The apparatus is also provided with a cam shaft which, on being turned, causes a scraper or scooper at its middle to carry small finishing quantities of the material to be weighed into the bucket, after which the rack and bucket continue their descent and the spring catches which hold the bucket wheel are released by hammers, and the bucket wheel is left free to rotate for the purpose of dumping its load.

An improved clothes washer has been patented by Mr. William Watlington, Jr., of Stony Point, Ind. The object of this invention is to save time and labor in washing clothes. This machine is simple in construction and effective in its operation.

An improvement in machines for winding silk has been patented by Mr. Henry H. Bartlett, of Watertown, Conn. The object of the invention is to soften raw silk and prevent generation of electricity in boiled silk during the process of winding. The invention consists in providing the winding machine with a steam generator for dampening or moistening the silk by a spray of steam, whereby the gum on the raw silk is kept soft, and in the case of boiled silk it is rendered flexible while being wound, and the generation of electricity is prevented. The steam generator for effecting these results is arranged below the swifts of the machine, and is provided with perforations in its upper side for the distribution of steam to the silk on the swifts.

A new fluid pressure regulating valve has been patented by Mr. William M. Sloane, of Brooklyn, N. Y. This invention relates to that class of valves for regulating the pressure of gas, steam, air, or other fluid, or, rather, for delivering such fluid under a uniform and reduced pressure from a reservoir thereof under high pressure, which usually consist of a valve opening against the high pressure and a diaphragm tending to keep this valve open, while the pressure admitted through the valve on one side of the diaphragm tends to keep the valve closed, which actions and reactions cause the gas to be delivered uniformly under the desired pressure, according to the adjustment of the diaphragm.

An improved machine for cutting ice has been patented by Mr. Chauncy A. Sager, of Valparaiso, Ind. The invention consists in the combination with a traction ice-cutting machine of a peculiar laterally swinging cross-cutting device for cross-cutting the ice at right angles to the line of motion of the machine, and while the machine is in motion making longitudinal cuts. The frame of the machine is mounted on wheels and carries a vertically swinging arm having a longitudinally cutting saw attached, operated by suitable mechanism, also carrying a laterally swinging frame depending from a vertically adjustable frame and supporting a longitudinally moving revolving shaft with a cross-cut saw thereon, springs serving to control the longitudinal movement of said shaft. Devices are also provided for holding the pulley which drives this shaft in position and the cross-cut saw and its shaft in place for cross-cutting the ice while the machine is being propelled forward.

Mr. William P. Brosius, of Richmond, Va., has patented a steam gauge for sewing machines. The object of the invention is to provide a device which shall enable the operator to run subsequent rows of stitching in parallel position to and at regulated distances from the first; and the invention consists in a peculiar construction and arrangement of a gauge composed of a spring arm with a stop or guide lug at its lower end, a horizontally adjustable slide carrying said arm, and a block adapted to be attached to the presser foot, which block is connected to the adjustable slide by a set screw and a rib or groove, which prevent the slide from turning axially about the set screw.

NEW SHOT-CASE AND DISTRIBUTER.

The improved shot-case shown in the engraving is of cast iron, japanned and ornamented, and provided with glass windows which expose the different kinds of shot to view. The case contains as many compartments as there are windows, and each compartment has an aperture at its bottom communicating with a hollow cylinder in the center through which works the vertically adjustable valve tube, as shown. The lid fitted to the top of the vessel may be turned independently of the shell. The lid controls and rotates the adjustable valve tube, therefore, if the index knob of the lid is pushed to the center of any division, the contents of that particular division may be drawn by pressing down the tube. A scale pan swings immediately under the discharge tube and receives the shot. When the desired quantity has been weighed the hand is removed from the knob and the flow of shot is instantly stopped. The vessel rests and rotates on a circular stand which supports the weighing attachment, consisting of a simple balance beam, a scoop, and nested weights.

A revolving disk indicates the grade of shot in any division. In the lid there is an opening through which the case is filled. This opening is provided with a cover that swings around automatically and closes the opening, excluding dust. A spiral spring holds the vertical tube and rests upon and presses the automatic cover, keeping it always closed.

This case, aside from being a great convenience in retailing shot and effecting a considerable saving in shot by avoiding spilling, prevents the shot from becoming mixed. It is well

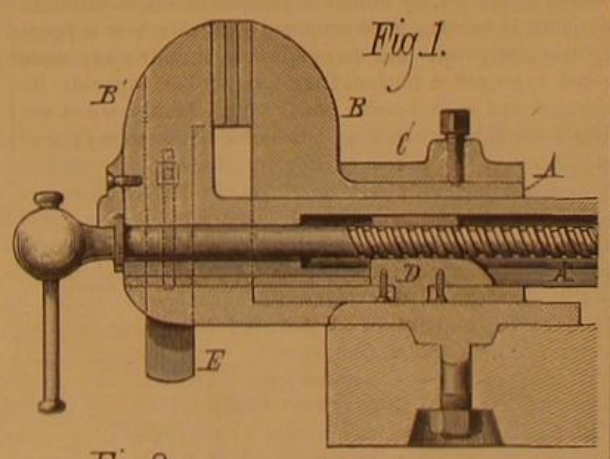
BOOTON'S SHOT-CASE AND DISTRIBUTER.

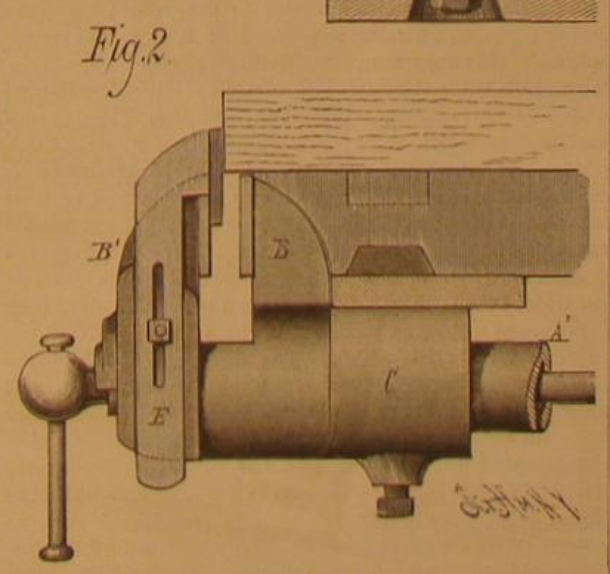
known to sportsmen that shot of different sizes discharged together will fly irregularly and render the shot inaccurate and ineffective.

For further information address S. Booton, of 105 Worth street, New York city.

IMPROVED VISE.

The vise shown in the accompanying engraving is especially designed for woodworkers, and is capable of being arranged above the bench, or at its side, or underneath. The vise has an outer cylinder, A, cast with the inner jaw, B,





HENDRY'S VISE.

and an inner concentric tube, A', is cast with the outer jaw, B'. These jaws may be provided with removable wooden faces to prevent marring planed work when held between them. The outer cylinder is received by a collar, C, cast with a securing base and bolt for the attachment of the vise to the work bench.

The vise is capable of being revolved in the collar, or the collar upon the outer cylinder, to permit of reversing its point of attachment to the under side of the bench, as seen in Fig. 2.

A screw is connected to the inner tube, A', so as to revolve independently and effect its movement back and forth. This screw is received by a tubular nut, D, in the tube, A'.

To the sides of the movable jaw, B', are applied adjustable plates, E, having slots and adjusting screws. These plates have affixed to their front edges a cross piece or face connecting the two plates together upon the inside of the jaw.

By reversing the attachment of the vise to the under side of the bench, as seen in Fig. 2, the face of the device, E, can be presented toward the end of the bench and be adjusted so as to stand above the bench, and hold one end of the board being planed or otherwise operated upon while being held by the usual bench stop at its other end.

This invention was recently patented by Mr. Alexander Hendry, of Fayetteville, Ark.

The Extraction of Sulphur from the Ore.

A new method of extracting sulphur from the rich native ores of Sicily has been invented by MM. de la Tour du Breuil, and the process is perhaps adaptable to other sources of sulphur, notably spent oxide from gas purifiers. The old Sicilian method of roasting the ore and melting the sulphur, in piles similar in construction to charcoal-burners' kilns, was very wasteful, and gave rise to the diffusion of intolerable fumes of sulphurous acid. The new process is very economical, and does not occasion any nuisance. The principle employed is that of raising the boiling point of water, by the presence of a salt, until it just exceeds 115° C.—the melting point of sulphur. Chloride of calcium is the salt employed in this case, on account of its fixity, cheapness, and complete inertia in presence of sulphur at the temperature attained in the process. The mode of operation is exceedingly simple. Two rectangular boilers, coupled together and inclined in position, are heated alternately from one furnace. The liquid, containing 66 per cent of chloride, is introduced into one vessel which is previously charged with sulphur ore. The process of liquefaction takes two hours; and, the other boiler being meanwhile emptied and recharged, the work goes on alternately without interruption. The method is said to be exceedingly economical, the cost of extraction being about five francs per ton. The sulphur is recovered in a state of great purity, and as it is only melted in a water bath instead of sublimed, there are no fumes evolved. The extraction is, moreover, very complete, not more than two or three per cent of sulphur being left in the matrix, even in the case of raw ore; while with such finely divided material as sulphur oxide the residuum irrecoverable by the process would probably be even less. The greatest recommendations of the process are apparently held to be its freedom from sulphurous acid exhalations and its great simplicity, not even a steam boiler being required; although the liquefying vessels might perhaps be heated with advantage by steam pipes, containing steam at a pressure of about twenty pounds above the atmosphere. These and other modifications might be found advisable if the process were tried on a large scale for the continuous treatment of sulphur material.

The Expenditure of Energy in Incandescent Electric Lighting.

At the York meeting of the British Association, Sir W. Thomson and Mr. Bottomley gave the results of some experiments carried out by them in order to determine the illuminating power of incandescent vacuum electric lamps with various strengths of current. Every lamp was tried with higher and higher potentials until the carbon broke. The electricity was obtained from a number of Faure's cells, of which 26 were first put in circuit, developing 0·093 horse power, and others were added until the lamp was destroyed. Three lamps only were tried, the first of which broke down after fourteen experiments; the second lasted through fifteen tests; and the third broke before the third reading could be completed.

With 26 cells the first lamp gave the illuminating power of 11·6 candles; 4 more cells then brought it up to 25 candles; with 32 cells it showed 42 candle power; and successive additions of cells forced the light up through a very irregular scale until, when giving the maximum of 114 candle power, the carbon gave way. The next lamp was first tried with 40 cells, affording 0·27 horse power, and giving the light of 49 candles; and the lamp broke when connected with 70 cells, when the light would have been over 200 candles. The irregularity of all the records is very striking, the power of the batteries and the light given by the lamps being very uncertain and by no means increasing in any common ratio. For example, the first lamp gave the light of 84 candles, with the expenditure of 0·247 horse power, from 40 cells. The next lamp, with the same number of cells, gave only 49 candle power in one instance and 35 candles in another, although the energy of 0·27 horse power was recorded, or nearly the same as before. Again, the second lamp gave 186 candle power with 56 cells, while the addition of 6 more cells, instead of increasing the light, brought it down to 180 candles. Much of this variation is said to be caused by the blackening of the interior surface of the globes by the deposition of volatilized carbon, when high powers were applied. The photometric method employed by the authors consisted of directly comparing the depth of shadows thrown by a pencil on a piece of white paper, and the candle employed was the usual standard sperm article, assumed to burn at the normal rate, but not weighed, as the object of the experiments was simply comparative.—*Journal of Gas Lighting.*

Calcium.

(Symbol, Ca. Combining weight, 40.)

This element, although not existing in nature in the metallic state, is very plentifully distributed in combination with other elements. Chalk, limestone, and many other rock formations contain a large proportion of calcium, and as several of its compounds are applied to many practical and industrial purposes, the study of this element becomes of some importance. The metal itself is prepared with some difficulty by decomposing the chloride by means of a strong galvanic current; when thus separated, calcium occurs as a light yellow metal, which readily oxidizes in the air, forming CaO, the only oxide of the metal known. Calcium also decomposes water with formation of the hydrated oxide and liberation of hydrogen.

Calcium Oxide, or Lime, CaO.—This important substance is obtained by heating chalk or limestone to redness, when the carbonic acid is expelled, and CaO, or *quicklime*, as it is technically called, is left behind. It may be obtained in a state of almost absolute purity by heating Iceland spar or white marble in a crucible to redness; prepared in this way lime is a hard but brittle substance, white in color and absolutely infusible. The lime of commerce, being prepared from an impure carbonate, contains traces of iron, which give a slight yellow color, and also a small quantity of silica, which sometimes causes the mass to partially fuse. When quicklime is sprinkled with water, it slakes with great violence; a chemical combination takes place, with the usual accompaniment of considerable heat, and the hard lime eventually crumbles down to a soft, white bulky powder; this slaked lime is the hydrated oxide, and has the following composition, CaO,H_2O. The heat produced during the slaking of quicklime is very considerable, and is a matter of common observation; in some cases it has been found sufficient to char and even kindle dry wood, and fires have been caused in this way. By exposing the hydrate to a strong red heat the water can be driven off, and quicklime again obtained. The hydrated lime is slightly soluble in water, but, strange to say, more so in cold than in warm water; one gallon of cold water (60° Fah.) will dissolve about 90 grains of CaO, while the same quantity of boiling water will dissolve only 60 grains. This lime water possesses a distinct alkaline reaction, in this respect resembling, although to a less degree, the hydrated oxides of potassium and sodium; it is used by the chemist as a test for the presence of carbonic acid, as the surface of the liquid will become instantly covered with a white pellicle of calcium carbonate if exposed to an atmosphere containing any carbonic acid. Quicklime is largely used for building purposes and for increasing the fertility of the soil. Ordinary mortar is made by mixing quicklime, water, and sand together; the mixture, which is at first pasty, gradually hardens, partly by evaporation of moisture and partly by the absorption of carbonic acid from the atmosphere. Hydraulic mortars or cements are made by heating together limestone and a peculiar kind of clay; the burnt mixture contains lime and silica, which to some extent combine on addition of water, causing the mass to set as hard as stone. Lime is also largely used in agriculture as a fertilizer; it is specially valuable on stiff clay lands, where it serves to decompose the silicates of the clay, and thus liberates certain potash salts which are essential to the growth of plants. Lime wash, or milk of lime, as it is sometimes called, is very useful in the brewery for painting the interior of vats and utensils when not in use; the lime acts beneficially by destroying the vitality of any organisms which may have collected on the surface of such vessels, and also by counteracting the acidity which always develops in the pores of unused brewing vessels.

Salts of Calcium.—Several of these are of considerable importance, and are used in many industrial processes; the compounds of calcium have a special interest to brewers, for some are found in most well waters, and are believed to exert a marked influence on the brewing operations.

The carbonate, $CaCO_3$, is the basis of most of the other salts of calcium, and is found in large masses in nature, forming whole mountains of limestone and marble, and also occurring in large masses, as chalk, coral, etc. Carbonate of lime, as it is still more commonly called, is practically insoluble in pure water, and yet it is found as a constituent in almost all river and well waters. This is due to the fact that these waters always contain some carbonic acid dissolved in them, and this acid keeps the carbonate in solution. In this way as much as twenty to twenty-five grains of carbonate of lime per gallon are held in solution. The presence of carbonate of lime gives the character of hardness possessed by some waters; but it is only a temporary hardness as distinguished from the permanent hardness produced by other and more soluble lime salts. It is called temporary, because this hardness can be destroyed by boiling the water; the excess of carbonic acid being expelled by heat, the carbonate deposits in the form of a crystalline powder, and often as a hard incrustation, which is a source of great trouble and danger to steam users. In brewing operations this carbonate of lime is rather beneficial than otherwise, for it serves to check any undue acidity in the malt, and for this reason it is not advisable to cause the whole of the carbonate of lime to deposit by violently boiling the brewing water before mashing. An ingenious method of destroying the temporary hardness of the water was suggested by Dr. Clark, whose process consisted in adding a sufficient quantity of lime dissolved in water to combine with the excess of carbonic acid, which then separates in the form of carbonate, carrying down with it nearly all the carbonate of lime originally present in the water and now no longer soluble, after removal of the carbonic acid. Many suggestions have been made for preventing this incrustation of steam boilers by deposit of carbonate of lime; among the most rational is the addition of some sal ammoniac (chloride of ammonium), which, by double decomposition, leads to the formation of chloride of calcium, a very soluble salt and carbonate of ammonium, which is volatilized by heat; but the objection to this method is the corrosive action which the vapors of carbonate of ammonium exert on engine fittings when the steam is used for obtaining motive power. A better way of preventing incrustation is to add some flocculent matter to the water, which serves as a surface on which the carbonate can deposit, thus preventing the crust being formed on the boiler plates. Chemists use a standard solution of soap for determining the hardness of water, and this solution is made of such a strength that each degree represents one grain of carbonate of lime per gallon. A known quantity of the water being taken, the soap solution is carefully added, until, on shaking the mixture, a permanent lather is formed, which takes place so soon as the lime salts are all precipitated.

The sulphate, $CaSO_4$, better known as gypsum, is also found in considerable quantities in some localities, often associated with rock salt; in its natural state the salt is generally combined with two molecules of water, which, however, can easily be expelled by heat, and then the powdered residue is known in commerce as plaster-of-Paris, and is largely used for making casts or moulds, as, on being mixed into paste with water, it becomes hydrated again, and sets into a hard mass. Calcium sulphate, or sulphate of lime, as it is still more commonly called, is slightly soluble in water, one part requiring about 500 parts of water for its solution; like lime, it is less soluble in boiling water than at lower temperatures. Several salts, especially common salt (chlorjde of sodium), greatly increases the solubility of sulphate of lime in water. Most well waters contain sulphate of lime as a constituent, and brewers have long known that this salt exerts an appreciable influence on the brewing processes; one of the peculiarities of the celebrated Burton waters is the presence of a considerable quantity of sulphate of lime, and it is believed this salt removes from beer worts, or perhaps prevents the solution of certain nitrogenous constituents which are very prone to decomposition, and which, if left in the beer, would lead to its destruction as a drinkable fluid; in whatever way sulphate of lime may act, there is no doubt that its presence in a brewing water materially affects the character and flavor of the beer brewed with it. There is one objection to the presence of sulphate of lime in a brewing water, and that is that it is liable to undergo a reduction to the state of sulphide by removal of oxygen, which change is brought about, there is reason to believe, by minute organisms called bacteria; this sulphide is, in its turn, decomposed as rapidly as it is formed by the acids, which are always present in beer, and sulphureted hydrogen, a foul-smelling gas, is thus evolved. The peculiar and objectionable smell which beers brewed with water containing much sulphate of lime acquire in warm weather, may be accounted for in this way. Sulphate of lime also contributes to the hardness of natural waters, and, not being removed by boiling, it is described as *permanent;* the soap test previously alluded to is also valuable for determining this hardness; by applying it to the well-boiled water —that is, after all the carbonates have been removed by boiling—the amount of sulphate of lime may be easily determined.—*Brewers' Guardian.*

A Convenient Pipette.

Sometimes the chemist hesitates to apply his lips to the end of a pipette when the lower end of it dips into strong ammonia, chlorine water, or, still worse, prussic acid, chloroform, and the poisons. How often the lips are burned with acid or blistered with alkali! C. Mann describes a modification which any chemist can apply for himself. A wide glass tube, that can subsequently be graduated, is drawn out at one end like a pipette and widened or bent outward at the other end. This tube or pipette is passed through a hole in a cork that fits a wider glass tube ten centimeters (four inches) long or more. The upper end of the wider tube is closed airtight with a cork. To make both corks set as tightly as possible in the wider tube they are rubbed with powdered rosin. The upper half of the thinner pipette tube is greased to make it slip through the cork more easily. The narrower tube is shoved up into the wider one until the end is very near the cork. The lower end is then dipped into the liquid and the wide tube pushed up with the finger, leaving a vacuum in the tube into which the liquid rises. With a gentle pressure the liquid rises so quietly that even small drops can easily be taken off the surface of a liquid in a narrow cylinder. Besides using it for corrosive liquid and for taking off the upper or lower of two that do not mix, it can also be employed for taking up slight precipitates on the bottom of a vessel, or for passing one liquid to the bottom of another without disturbing the latter.

Another device for filling pipettes with fuming liquids consists in keeping the liquid in wide mouthed bottles provided with double bored corks, through one of which orifices there passes a short bit of glass tubing bent at right angles. On passing the tube of any pipette through the second orifice and blowing through the shorter tube the liquid will rise to any desired height in the pipette. Most pipettes have delivery tubes of one size, and hence different pipettes can be inserted successively in the same cork if desired.

Frequently a wash bottle is inserted between the mouth and the pipette, and then the liquid is sucked up into it. Where solutions of chlorine or sulphurous acid are to be pipetted, suction of any sort reduces the pressure and may cause a loss of gas, and leave a weaker solution behind.

P. N.

MISCELLANEOUS INVENTIONS.

Messrs. Nathaniel F. Harris and Martin Thoeni, of Monticello, Iowa, have patented an improved metal can for packing butter, etc., so constructed that air shall be completely excluded from the contents when the cover is soldered on, and so that the molten solder shall not heat the contents, and the cover can be easily unsoldered without injury to the can. The body of the can is formed with an outwardly flaring rim, and the cover also with a flaring rim. These rims are so arranged as to leave a space between them and form a groove for reception of a stripping wire which is soldered to the two rims, and serves to unite the cover with the body of the can.

Mr. James B. Pollock, of Port Richmond, N. Y., has patented a ventilating apparatus for white lead stacks. This invention consists in a combination in a white lead corroding stack or bed with the tiers of pots containing the lead and boards covering the same, of a board lining of the central ventilating flue made in sections, extending from the covering boards of one tier of pots to the bottom of the next tier, and in providing the flue with valves controlling the several tiers, whereby the ventilation may be regulated as required and the tan bark of the stack is prevented from falling into the flue.

Mr. Charles W. Minear, of Kirksville, Mo., has patented a baling press. The object of this invention is to facilitate the compression of hay, cotton, straw, moss, and other substances into bales. In this press the baling box is mounted upon wheels for convenience in moving it from place to place. The power is applied to a horizontal sweep fast upon an upright shaft, and the connection with the follower made by a chain through the intervention of a cam having a sleeve fitting said shaft, a cam plate fast on the latter provided with a spring catch bar, which engages and disengages with the cam, and a lever pivoted to the follower and having a rocking fulcrum connection with the baling box. By revolving the upright shaft the follower is forced forward, and means are provided for automatically releasing, at each revolution of said shaft, the operating cam, which controls the follower chain, also for permitting of the follower being drawn back.

An improvement in tooth brushes has been patented by Mr. Louis Chevalier, of Brooklyn, N. Y. The object of this invention is to provide a brush with a reservoir for water to be used during the application of the brush. The invention consists in the peculiar construction of a brush having attached to its handle an elastic bulb or bag, that communicates with the bristle plate or face of the brush by means of a tubular passage formed through said plate and handle, the end of the tubular handle being extended to nearly the bottom of the bulb, whereby all the water in the bulb may be easily ejected when the brush is held with the bulb downward.

Mr. John Harvey Ludwick, of Dallas, Texas, has patented an improvement in reflectors for lamps and handles thereof. The invention consists in providing the lamp body with a flanged and recessed strip and the reflector with a projecting flange sliding into the recess of the strip, whereby the reflector is securely held in place and is readily detachable when desired. It also consists in a loop and catch connection of the handle of a reflector lamp with the reflector and body of the lamp, to admit of the detachment of the handle. This construction facilitates cleaning, repair, or renewal of the reflector, etc., also transportation.

Mr. Benjamin Goodyear, of Carlisle, Pa., has patented an improved device for handling and carrying jars, bottles, etc., safely and conveniently. The invention consists in a frame formed of a series of wires attached to a handle and to a ring, from which they project downward, and have their lower ends bent toward each other, so as to catch under the bottom of the bottle or jar.

Henry H. Heise and John H. Kauffman, of Columbia, Pa., have patented a steam generator for cooking feed, sweating tobacco, and other purposes. The invention has for its object the combining of simplicity with efficiency and perfect safety. It consists of a cylindrical fire box having a deflecting arch mounted upon a suitable grate and base and provided with a concentric fuel magazine, in combination with a lengthening cylinder for enlarging the fire chamber, and an outer inclosing steam generating chamber provided with the usual boiler appliances.

Mr. Alfred S. Clark, of New Orleans, La., has patented an improved machine for brushing and polishing boots and shoes on the foot of the wearer. The invention consists in a reciprocating rod provided with brushes at the sides and bottom and guided in the legs of a frame, to which a swinging lever is pivoted, actuated by a crank and intermediate cogwheels, and connected with the brush rod, which it reciprocates.

Mr. Christian H. Scheermesser, of McKeesport, Pa., has patented an improved tube drawing mandrel for forming lap welded tubes. It will not stick in the tubes and will permit of quicker and easier drawing and better welding.

WASPS AND THEIR NESTS.

The common wasp is found all over the globe, and is known by its long slender body, colored yellow and black, and by its four wings, two of which are folded double over the back when in repose.

The true wasp is always social, living together in large numbers. Wasps may be divided into three classes, male, female, and neuter; only the two latter are provided with stings. One radical difference between the bees and the wasps is that the wasps do not secrete wax. They build their nests of a gray or reddish paper, formed of fibrous substances that they tear off with their powerful mandibles, and fasten together with their gluey saliva. The arrangement of the cells is also slightly different. Another peculiarity is the desertion of the wasps' nest at the first frost.

The perfect females pass the winter hidden in the moss, on the ground, or in the holes in walls or trees. In the spring they awaken from their long sleep and start out to seek food. They attack the blossoms of the young fruit trees, and, later, the currant bushes. This is the best time to destroy as many wasps as possible, for each female wasp that is killed prevents the formation of a nest.

The food of wasps and the mixture they feed to their larvæ is much more varied than the nourishment of the bees. Wasps are fond of all kinds of sweet things, especially honey, which they often try to steal from beehives. Their tongues are too short to obtain honey directly from flowers, but they attack the ripe fruit where the skin has been broken by rain or birds; they drink the sweet sap exuded by trees, and from these substances they make a tolerably sweet honey, which they store away or feed to their young. Wasps will also seize living insects, even spiders, and tear them apart to feed to the larvæ. In the autumn they will even come inside the window to seize the housefly, and in the woods, one can often notice the sudden disappearance of all flies at the approach of a hornet. They will voraciously devour the meat exposed on the stalls in the market, and often cause serious loss to the careless butcher.

Wasps are much more nocturnal in their habits than bees; and it must be remembered that in the evening, when it is perfectly safe to handle a beehive, it may be dangerous to attack a wasps' nest, as the wasps may still be flying in and out.

In France, the wasps generally make their nests in holes, either in the earth or in trees and walls, and under the roofs of houses. Nests have even been found in old barrels and deserted beehives, the remnants of whose honey had probably served to nourish the intruders.

The underground nests are very brittle and easily broken, as they are made of bits of decayed wood and bark glued together. They are the color of fallen leaves. The common wasp and the "*German wasp*" are very similar, and generally build their nests in the abandoned holes of the field mice and moles. They dig out the earth to enlarge the nest, and spread it in little piles about to hide the entrance to the hole.

In the ordinary nest the comb is protected by a concentric covering and divided into three distinct parts: 1st. One or perhaps more combs or layers of hexagonal cells. 2d. Pillars that join and support the different combs. 3d. An outside covering composed of several membranes of paper, which is covered with a sort of gluey varnish that is secreted by the wasps' tongues, and gives the nest a silvery varnish. On account of this varnish and the convex form of the nest, neither the rain nor cold can penetrate into it, consequently the temperature of the nest is higher than that of the atmosphere, sometimes being fourteen or fifteen degrees warmer.

The mother wasp commences her nest in the beginning of summer, and first constructs a foundation of woody fibers, which she builds up in the form of a capsule, forming in the center eight or ten cells, to which she adds new cells when necessary.

The first eggs are always working wasps or neuters, and the mother wasp is forced to leave the nest frequently to obtain nourishment for them. Afterward, when these are grown, they do all the work, enlarging the nest, providing food for the later larvæ; and from this time the working wasps, which can easily be distinguished by their more slender bodies, are the only ones that are found flying.

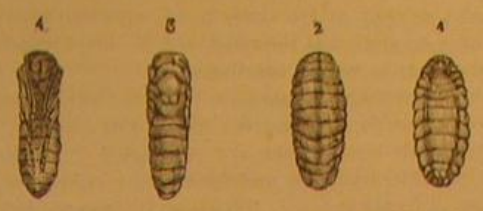


Fig. 1.—Eggs of the Common Wasp: Larva—1, beneath; 2, above. Nympha—3, above; 4, beneath.

From the first of August to November the mother only lays the eggs of males and perfect females.

The larvæ (Fig. 1), which are white and without legs, are attached to the cell by the extremity of their abdomen, and hang head downward. There are two brilliant spots on their heads, and their mouths are stronger than those of the bee larvæ, as they receive tougher food. When the larvæ are fully grown they turn over and weave a slight tissue of silk around themselves and the cell, then, resuming their old position, they close the opening of the cell with a thicker silk, and remain quiet for several days. At the end of that time the larvæ have become nymphæ, which are the complete wasp, covered with a thin skin, through which can be seen the three divisions of the body, with their developed organs folded under the abdomen. These nymphæ are at first white, and then gradually become colored, commencing always with their black eyes; and for several days after they have broken their coverings the wasps are less yellow than they become afterwards. When fully grown the wasp tears the silk tissue and breaks open its cell with its mandibles and flies out of the nest.

A third species, less known, is the red wasp, which frequents only the woods and builds its nest underground. The nests are small and not populous. These underground nest-builders may be distinguished from the common wasp by their abdomens, which are not all yellow and black, but are either red or striped with red. These wasps have numerous enemies, among whom the volucellis are the most formidable, as they are colored somewhat like the wasp, and consequently can easily penetrate into the nests and eat the larvæ, thus rendering us a great service in those warm dry seasons when the wasps' nests are overflowing with their intolerable brood.

The hornets' nest is much larger than all other varieties, and is usually built in hollow trees or under large roots on the ground, or in old walls, chimneys, etc. These nests, which are composed of a sort of pulp of decomposed wood, are very friable. They have a single envelope, and are always placed in some hole for an additional covering and protection. Hornets are very irritable and will attack in crowds any one who they think will hurt their nest. They seek to attack the places where the body is unprotected by clothes, and as their repeated stings are very dangerous, it is best always to rush to the nearest water and completely submerge one's self.

Fig. 3.—WOOD WASP AND NEST, SHOWING ARRANGEMENT OF THE LOWER COMBS.

Strange to say, in spite of the hornet's peculiarities and carnivorous instincts, it has one friend in the insect world. It is a large black coleoptera, the *Velleius dilatatus*, distinguished by the peculiarity that, when disturbed, it drops its body and trains it on the ground like a little lizard. This insect follows the wasp in the evening into the nest, of which it makes itself the protector. It furiously attacks all insects that are hurtful to the young wasps, especially the centipedes, which they continue to shake long after the insect has been torn to death by their powerful mandibles. It is also possible that the strong odor of muck about the *Velleius* may be pleasant to the hornets and agreeably perfumes their nests. In return, the hornets permit it to eat some of the honey, of which it is very fond.

Though this insect is very timid at first, it soon becomes accustomed to any one who will properly nourish it, and can be easily domesticated in order to observe its habits. It can be taught to take honey from the end of a fine brush, and it will cling so tightly to its food that it is difficult to make it let go.

There are a few wasps that build their nests entirely uncovered, simply attached to the branch of a tree. These nests are made of woody fibers, torn from decayed wood or plants, and are very flexible and elastic.

The concentric envelopes on the outside of the nest have such a great resemblance to gray filtering paper, that it would seem as if the wasps had preceded man in the invention of paper. This species is the wood wasp, Fig. 3. It is a little smaller than the common wasp; the female has a more velvety body, and the neuter is quite smooth. This species is spread all over Europe, except perhaps in Lapland.

There is another group of wasps that are distinguished by the inferiority of their nests, which are never provided with an envelope to protect them from the weather. These nests are simply a comb supported on a strong stand; the cells are oblique or recessed, and more or less numerous according to the size of the brood.

These wasps are more slender than the ordinary wasp, fewer in number, less irritable, and much less destructive to fruits and plants. In the month of April this wasp (Fig. 2) can be seen commencing his little nest in some warm spot exposed to the sun

Fig. 2.—WASPS' NEST WITH THE MOTHER WASP.

but well sheltered from the rain. These wasps are so gentle that even if the nest is carried away the mother wasp will not offer to sting, but clings to the nest or flies close to it. If the branch with the nest on it is carried into a house she will still follow and continue to feed her eggs. When these are hatched they readily become accustomed to the presence of man, and it is possible to observe, at home, the habits and development of these curious insects.

Military Ants of the Amazon.

The *Nineteenth Century* has the following: The most astonishing insects, if not the most astonishing animals, in the world, are the so-called "foraging," or, as they might more appropriately be called, the military ants of the Amazon. They belong to several species of the same genus, and have been carefully watched by Bates, Belt, and other naturalists. The following facts must therefore be regarded as fully established.

Eciton legionis moves in enormous armies, and everything that these insects do is done with the most perfect instinct of military organization. The army marches in the form of a rather broad and regular column, hundreds of yards in length. The object of the march is to capture and plunder other insects, etc., for food, and as the well organized host advances, its devastating legions set all other terrestrial life at defiance. From the main column there are sent out smaller lateral columns, the composing individuals of which play the part of scouts—branching off in various directions, and searching about with the utmost activity for insects, grubs, etc., over every log and under every fallen leaf. If prey is found in sufficiently small quantities for them to manage alone, it is immediately seized and carried to the main column; but if the amount is too large for the scouts themselves to deal with, messengers are sent back to the main column, whence there is immediately dispatched a detachment large enough to cope with the requirements. Insects or other prey which, when killed, are too large for single ants to carry, are torn in pieces, and the pieces conveyed back to the main army by different individuals. Many insects in trying to escape run up bushes and shrubs, where they are pursued from twig to twig by their remorseless enemies, till on arriving at some terminal ramification they must either submit to immediate capture by their pursuers, or drop down amid the murderous hosts below.

As already stated, all the spoils which are taken by the scouts, or by the detachments sent out in answer to their demands for assistance, are immediately taken back to the main army or column by two smaller columns of carriers, which are constantly running in two double rows (one of each being laden and the other not) on either side of the main column. On either side of the main column there are constantly running up and down a few individuals of smaller size, lighter color, and having larger heads than the other ants. These appear to perform the duty of officers, for they never leave their stations, and while actively running up and down the outsides of the column, they seem intent only on maintaining order in the march, stopping every now and then to touch some member of the rank and file with their antennæ, as if giving directions.

When the scouts discover a wasps' nest in a tree, a strong force is sent out from the main army, the nest is pulled to pieces, and all the larvæ in the nest are carried by the carrier columns to the rear of the army, while the wasps fly around defenseless against the invading multitudes. Or, if the nest of any other species of ant is found, a similarly strong force is sent out, or even the whole army may be deflected toward it, when with the utmost energy the innumerable insects set to work to sink shafts and dig mines till the whole nest is rifled of its contents. In these mining operations the Ecitons work with an extraordinary display of organized co-operation; for those low down in the shafts do not lose time by carrying up the earth which they excavate, but pass on the pellets to those above, and the ants on the surface, when they receive the pellets, carry them only just far enough to insure that they shall not roll back again into the shaft, and, after having deposited them at a safe distance, immediately hurry back for more.

The Ecitons have no fixed nest themselves, but live, as it were, on a perpetual campaign. At night, however, they call a halt, and pitch a camp. For this purpose they usually select a piece of broken ground, in the interstices of which they temporarily store their plunder.

Transparencies Produced by Luminous Paint.

BY ROBERT VINCENT.

In May last I forwarded a brief account of a plan that I had employed for some time past for producing transparencies. The method is at once so simple and satisfactory that I do not hesitate again to call attention to it, and to recommend it particularly for making transparencies of large dimensions.

To give some idea of the sensitiveness of the gelatine plates that I employ, I may mention that an ordinary fish-tail burner at six feet distance will produce an excellent transparency in ten seconds, or, if the negative be dense, then fifteen seconds are required. In these circumstances, it may be asked, why resort to any other means of illumination?—there is nothing more handy than a gas jet, or less costly; while if the flame varies a little with the pressure, the difference in practice is scarcely observable.

I will try to explain the advantage of luminous paint over a gas-burner in the production of transparencies. In the first place, there are few dark rooms in which a suitable jet is to be found, or, if a suitable jet exists, it is not always in a convenient position for making exposures. Again, besides the vitiated atmosphere that results when a number of exposures are made in a close room, with the gas burning some time, there is the inconvenience of turning the light on and off continually during the operation; with a luminous paint screen, on the other hand, no clear intervening space of several feet is required, and its employment does not necessitate increased ventilation.

But the advantage of luminous point for transparencies is best seen when large negatives have to be copied. I have an "Aladdin's lamp," which I purchased of Ihlee and Horne, of Aldermanbury, and for which I paid eight or ten shillings—I forget exactly. This is nothing more than a big surface of luminous paint, framed, and glazed. With it I can produce transparencies up to 15 by 12. To do this with a gas-jet is of course quite possible, if you are at a considerable distance, but it is ten chances to one the whole surface of the negative is not uniformly impressed with the rays, which, under any circumstances, are not parallel. In the case of the luminous paint-screen, however, it is merely necessary to clap the printing-frame (containing the negative and the gelatine plate) face downward upon the "Aladdin's lamp," which has been previously exposed to daylight, and in a few seconds the exposure is complete.

It is a mistake to suppose that the exposure must needs take place the instant the "Aladdin's lamp" is removed from the daylight. If you use the "lamp" fresh, the chances are you will over-expose. Employed within one minute of its withdrawal from light—I am speaking of ordinary diffused daylight—an exposure of one second will often be too much; taking such plates of the sensitiveness I have mentioned, and the normal oxalate development (Dr. Eder's formula), which, for transparencies, at any rate, I much prefer to pyrogallic development. On the other hand, if, instead of using the "Aladdin's lamp" immediately, you wait five, ten, fifteen minutes, after withdrawal from daylight, you will find the light much more under control. I have made a dozen transparencies without re-exposure of the "lamp" to daylight. I find that, with my lamp, an exposure of three or four seconds is required after five minutes' withdrawal, an exposure of fifteen seconds after ten minutes, and an exposure of twenty five seconds after fifteen minutes—this with a negative of normal density. The delicate detail in the shadows so soon gets lost that over-exposure should always be avoided if you want a bright and vigorous transparency.

If your dark-room is not well lit, as soon as you have poured over your developer, you may turn the "Aladdin's lamp" round and use its light to develop by; I have never found any ill effects from its light, if only the development has begun before the "lamp" is made use of.

It is only since I have taken to the production of large transparencies that I purchased an "Aladdin's lamp." For many months I used nothing but a piece of cardboard, coated myself simply with the luminous paint, and protected from dirt by a piece of glass. This answers admirably for whole plates or any smaller pictures, and those who can obtain a small amount of the paint can perfect for themselves an "Aladdin's lamp" up to any size. The paint, when I inquired the price, was 28s. a pound, but a tiny sample I obtained was quite sufficient for the making of my first screen. I do not think there can be half an ounce of paint on the 15 by 12 "Aladdin's lamp" that I have, and therefore, if photographers could only purchase it in small quantities, the cost of a screen would be but nominal. Some of our apparatus dealers would find it worth their while to sell the paint retail, I should think, for any photographer who tries this plan of printing cannot fail to be satisfied with it.

To sum up the advantages of the "Aladdin's lamp" for making transparencies I would say:

The exposure can be more accurately timed than with a gas jet.

The rays being parallel, the transparency is more likely to be uniform in depth and tone.

There is no necessity for a space of several feet to intervene between the source of light and the frame; and finally, the "Aladdin's lamp" is not only more convenient and handy to use, but it does not, like a gas-flame, add further to the vitiation of the dark room.—*Photo. News.*

United States Fisheries of the Great Lakes.

The following statistics of the work of United States fishermen are taken from the report of G. Brown Goode, special agent of the fishery division of the United States Census Bureau, for the year 1879:

In the eight States bordering on the great northern lakes, including Pennsylvania, which has a comparatively limited lake frontage, there were 5,050 fishermen and 1,656 vessels, boats, and steam tugs engaged in taking fish. The value of these vessels, etc., was $266,000, and the total value of all apparatus and accessories was $1,345,975.

Of the eight States Michigan stands at the head as regards number of men, and Ohio in the value of investments, the latter being $233,600; the total fishing properties of the eight being valued at $497,400 in 1879.

Michigan, notwithstanding the less value of her investments, stands far ahead in the value of fish taken. Of the total, which was $1,652,900, her share was $711,695; the next being Ohio, at $355,000.

Whitefish, the kind taken in the largest quantity from the Michigan lakes, amounted to nearly 13,000,000 pounds, valued at $461,800, while the value of Ohio whitefish was only $39,500, or about one-twelfth as much.

The other States stand in the following order in total value of their fish products: Ohio second, $355,000; Wisconsin third, $276,605; New York fourth, $175,100; Illinois fifth, $53,000; Pennsylvania sixth, $42,480; Indiana seventh, $33,820; Minnesota eighth, $5,200. The whole of the fish taken by fishermen of the last named State are sold in fresh condition, while 11,000,000 pounds of the Michigan and Ohio fish, valued at about $300,000, are salted for market.

Of the salted fish nearly 600,000 pounds are pike taken by New York fishermen, which were sold for $12,000, barely two cents per pound.

Michigan, Ohio, Pennsylvania, and New York together sent 2,821,600 pounds of frozen fish to market, which brought $126,100.

The smoked fish came mostly from Ohio and Illinois, being largely whitefish and sturgeon. The total of smoked fish from the eight States was 1,721,770 pounds, valued at $109,970.

The report has also a grouping of the investments and products by lakes as well as by States, which shows that about 80 per centum of the investments in fish catching are on Lakes Michigan and Erie, 10 per cent on Huron and St. Clair, 6 per cent on Superior, and 4 per cent on Lake Ontario.

Under this grouping the values present different proportions as follows:

Lake.	Value.	Proportion.
Michigan	$668,400	about 40 per cent.
Erie	412,880	" 25 " "
Huron and St. Clair	293,550	" 18 " "
Ontario	159,700	" 10 " "
Superior	118,370	" 7 " "
Total	$1,652,900	100

There are other tables showing the quantities and values of caviare, isinglass, and oil made from the fish taken on the lakes. They show that all the caviare and most of the oil come from the sturgeon, and that from three-fourths to four-fifths of these three products come from Ohio.

Oil Painting on Woven Fabrics.

Canvas, indeed, is often employed by artists for oil paintings, but then the canvas is stretched tightly on a frame. To paint on loose cloth without entirely destroying its flexibility has hitherto been impossible. Besides this many colors lost their brilliancy, and hence are less effective upon woven fabrics.

Gutmann, of Florence, after many years of experimenting, believes that he has overcome all difficulties, and that with his process the goods will retain their freshness and pliability. The colors shall be as effective as those on the finest printed goods, and even surpass them. If the painting is done on silk or satin the colors have the appearance of enamel, and the shade varies with the gloss of the silk. As neither varnish nor gum is employed the colors preserve their freshness, which is heightened by exposure to the air and light. The colors cannot blacken in time, as is the case with oil colors; and, above all, the goods retain their softness.

A composition made of distilled water, molasses, benzole, turpentine, alcohol, and nitro-benzole, is poured into a vessel containing twice as much boiling water. During the whole operation it is kept at as high a temperature as possible, so that the greatest amount of vapor will be given off. If the mixture gets cold it cannot be used again. As soon as vapors are given off from it the wrong side of the goods is held over it for a few minutes, so that the vapor shall pass through the fabric. After drying for several hours it is ready for use, and may be stretched on a frame or over a piece of wood or cardboard.

In regard to the painting itself, the design is first sketched with an ivory stylus, and using impression paper—red for black or dark stuff and white for light colored. The little oil cans which always belong to the palette, and are generally filled with linseed oil, are now filled with a mixture of benzine, turpentine, alcohol, and nitro-benzole. When the pigment has been put on the palette, one or more drops of this mixture is dropped upon it, in order to dilute the color which is to be used. The pencils and brushes must also be soaked in the same peculiar composition every time before using them. The first coating is put on thick as a ground, so as to cover the stuff well. Everything that is to be pink, blue, or violet must have a white ground, which is allowed to dry one or two days. Little precautions about touching colors not yet dry are to be learned by experience.

P. N.

The Light of the Stars.

For a number of years the special work carried on at the Harvard Observatory, under the direction of Professor Pickering, has been the measurement of the intensity of the light of the heavenly bodies. Some of the results presented at a recent meeting of the Society of Arts, at the Institute of Technology, Boston, indicate measurements almost incredibly fine. The light which falls upon the earth from the satellites of Mars, for example, is about equivalent to what a man's hand on which the sun shone at Washington would reflect to Boston. The labor of measuring the brightness of all the visible stars was begun two years ago. It has since gone on at the rate of about 40,000 a year, and will be completed next fall.

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.

Shafting Straightened in Position by Scofield's Patent Straightener. J. H. Wells, Manufacturer, Vineland, N.J.

New Comb'd Milling and Gear Cutting Machines, large range. C. A. Condé & Co., Makers, Philadelphia, Pa.

Printing presses with Patented Card Drop. See p. 250.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock, 80 to 88 Market St., Chicago, Ill.

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Don't fail to see the New Automatic Engine built by the Lambertville Iron Works, now in operation at the American Institute, New York.

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Foot Lathes, Fret Saws, &c. 90 pp. E. Brown, Lowell, Mass.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Cope & Maxwell M'f'g Co.'s Pump adv., page 254.

Punching Presses & Shears for Metal-workers, Power Drill Presses. $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N.Y.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. 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.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro. 234 Broadway, New York.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Peck's Patent Drop Press. See adv., page 269.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 10 Cortlandt St., N.Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

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

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Saw Mill Machinery. Stearns Mfg. Co. See p. 269.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 268.

Improved Skinner Portable Engines. Erie, Pa.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 286.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 286.

Safety Boilers. See Harrison Boiler Works adv., p. 285.

Supplee Steam Engine. See adv. p. 270.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 286.

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

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

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Ball's Variable Cut-off Engine. See adv., page 300.

Paragon School Desk Extension Slides. See adv. p. 300.

Brass & Copper in sheets, wire & blanks. See ad. p. 300.

The None-such Turbine. See adv., p. 286.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Wren's Patent Grate Bar. See adv. page 301.

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

Berryman Feed Water Heater. See illus. adv., p. 300.

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

Ajax Metals for Locomotive Boxes, Journal Bearings, etc. Sold in ingots or castings. See adv., p. 300.

Eagle Anvils, 10 cents per pound. Fully warranted.

Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser Mfg. Co., Waynesboro, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 301.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares notions, and novelties in the above line, a specialty. See advertisement on page 301.

Rolled Nickel Anodes, Grain Nickel, Nickel Salts, Platers' Supplies. Greene, Tweed & Co., New York.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 301.

The Sweetland Chuck. See illus. adv., p. 300.

Turkey Emery, Star Glue, Pumice, Walrus Leather, Polishers' Supplies. Greene, Tweed & Co., 118 Chambers St., N. Y.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

New Economizer Portable Engine. See illus. adv. p. 300.

Cutters for Teeth of Gear Wheels formed entirely by machinery. The Pratt & Whitney Co. Hartford, Conn.

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

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

Common Sense Dry Kiln. Adapted to drying all of material where kiln, etc., drying houses are used. See p. 300.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N.J.

Skinner's Chuck. Universal, and Eccentric. See p. 300.

Don't buy a Steam Pump until you have written Valley Machine Co., Easthampton, Mass.

For Machinists' Tools, see Whitcomb's adv., p. 300.

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.

Correspondents sending samples of minerals, etc., for examination should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) "Harriet and Emily" ask if it is a scientific and philosophical fact and truth that an ice boat can possibly move faster than the wind. A. On good ice a well made ice boat will move much faster than the wind. A wind having a velocity of fifteen miles an hour will drive an ice boat at the rate of forty miles an hour.

(2) E. P. Y. asks: Which do the authorities on such things say is the proper position for sleeping, on the right or the left side, or on the back? A. If soon after eating lie on the right side; otherwise it is best to vary the position occasionally. It is not good to lie habitually in any one position.

(3) "Reader" writes: I have some bottles out of which I wish to make battery jars. Would you please tell me, through SCIENTIFIC AMERICAN, how I can cut the necks off? A. Bend a quarter-inch iron rod so that it will half encircle the bottle. Heat it to a low red heat, place the bottle in the bend upon the line of separation, and turn the bottle back and forth through part of a revolution in contact with the hot rod. When the bottle begins to crack turn it slowly around until the top is completely cracked off.

(4) I. J. M. writes: As you write and deal largely in the saving of "horse power" of one kind, I am emboldened to write asking your assistance in the saving of a horse power of another kind. I have a fine mare, which I am afraid has the itch. Will you be kind enough to let me know what will stop its spreading and cure it? I have tried most of the simpler remedies, such as sulphur and lard, etc., but find them next to useless. A. If the animal is a victim to a genuine case of itch, our opinion is that it will respond to liberal dressings of equal parts of tincture of iodine and glycerine mixed. We would also give two ounces of sublimed sulphur daily in her feed and thoroughly disinfect the harness, blankets, partitions, and in fact everything that has been in contact with her, with a solution of carbolic acid, diluted, the brushes especially, which should not be used upon any other animal.

(5) C. G. B. asks: 1. Can the commercial water glass be mixed with ground marble or other substance to form an artificial marble susceptible of high polish? A. Yes. See article on the subject, page 16, current volume. 2. Could it be colored, and if so, with what, say, for black? A. Lampblack, Indian red, yellow ocher, chrome green, etc., can be used in connection with these materials. 3. Where or of whom can water glass be obtained? A. See column of Business and Personal and Hints to Correspondents. 4. I notice that the "slack" cinders or refuse of soft or bituminous coal that has been burned is composed principally of iron and slate. Could not this be utilized in sidewalks by mixing with some plastic substance that would afterwards harden? What would be the best substance? A. Probably hydraulic cement of bitumen might be employed advantageously in this connection. 5. Please refer to numbers giving instructions for making cement sidewalks. A. See SCIENTIFIC AMERICAN SUPPLEMENT Catalogue. 6. Is there manufactured such an article as asbestos rope, or could rope be cheaply treated so as to resist decay when exposed to weather and moderate fire, and still be strong? A. We believe so. Address the dealers who advertise in this paper. 7. How can cellars without drains be cemented so as to exclude water and moisture? A. Put down a two-inch bed of concrete with cement, and cement over this for the floor.

(6) W. H. D. asks: 1. Is it best to leave a violin in tune after playing, or is it best to let the strings slack a little after playing? Does it not strain the violin if it is strung up always? A. Leave the violin in tune. 2. Is there anything that will make hair grow longer and stouter when there are plenty of little roots? If there is, what is it and where could I get some of it? A. Pilocarpine (or the hydrochlorate of this alkaloid), when administered by subcutaneous injection, is said to greatly stimulate the growth of hair.

(7) J. H. K. asks: Please let me know what proportion of platina surface, as compared with zinc surface, to use in a Smee battery, to get the best results? I have seen these batteries in practical use where the platina surface has varied from two-tenths to forty-one one-hundredths of what the zinc was, and as yet have been unable to find any one who knew what is right. I claim that it makes no difference how much larger your zincs are than the platina (as long as they are as large), and that the power of your battery depends on the size of the plating plates and the condition of the battery bath; but my friend claims different. I also claim that a battery with a platina plate, 12x12½ inches square, or with 300 square inches surface, with zincs to suit (working in a bath of one ounce acid to 16 ounces water), will deposit a copper shell one-one-hundred-and-fiftieth of an inch thick on a wax electrotype mould 18x21 inches from a copper anode 15x20 inches square in ten hours, if the connections are good and everything else in order. My friend says I would need large battery plates. A. The quantity of current from such a battery is increased somewhat by increasing the surface of the platinum so as to completely surround the zinc plate. When the cost of the platinum is taken into consideration, however, the gain in current by the increase of platinum surface beyond the dimensions of one of the zinc plates is not sufficient to warrant this modification. It does not matter how large an exposure of platinum surface in excess of that of zinc surface there is in such an element. As we understand your statement of conditions we do not think that your estimate of work done (in copper deposited) is excessive. Of course a stronger current would do the work more rapidly.

(8) J. E. K. asks: Can you tell us of an exterminator for roaches, with which our place is overrun? A. Finely powdered dry borax injected by means of a bellows, into all cracks and crevices infested with the roaches soon drives them away. Another good remedy applied in the same way is genuine Dalmatian insect powder. Chlorinated lime is also very effective.

(9) J. W. F. asks: Please inform me in what work I can find out how to make the material of which paint which is luminous in the dark is made? I do not want it for a paint but for another purpose. There is an article of which oyster shell is one ingredient, but anything that is solid might answer my purpose. A. You will find the information in article on Phosphorescent Substances, page 51, current volume. See also Useful Receipts, in SUPPLEMENT, No. 159.

(10) G. L. says: There is an unlimited amount of chalk, in its rough state, in this vicinity. The chalk is very soft, and is found in lumps of all sizes, and what I desire to know is, how or by what process I could make it suitable for billiard use, such as square blocks of chalk used for chalking cues. A. Reduce the chalk to a smooth thick paste by grinding it with water and about one per cent of wheat flour, mould into shape under pressure, and kiln dry at a temperature of about 100° Fah.

(11) H. L. asks: 1. How is a helix made? A. See "How to Make Induction Coils," in SUPPLEMENT, No. 160, and "Electrical Cabinet," in SUPPLEMENT, No. 191. 2. I have a battery of two carbons and one zinc; how is the connection made between battery and helix? A. Connect the wire from the carbon pole with one end of the helix wire and the zinc pole with the other so as to complete the circuit. 3. How can I make a plain black glass button look like a silver button or to give it a polish like nickel plating? A. See formulæ for silvering glass in SUPPLEMENT, No. 105.

(12) H. G. R. says: I have just laid a galvanized pipe, 1¼ inch, from spring to house, a distance of 300 feet. As you do not recommend the use of galvanized iron, can you tell me any way to remove the zinc from the inside of pipe without digging it all up? A. Owing to the unavoidable liberation of gas and the position of the pipes solvents cannot be depended upon to effectually remove all the zinc coating from such a conduit. We know of no practical way of satisfactorily accomplishing this without disturbing the line.

(13) A. B. R. asks: Can you give a recipe for making a cement for fastening rubber bicycle tire to the steel rims? The cement should be applied through the agency of heat, and a stick of it should not be brittle but easily bent at common temperature. A. A. Try the following: Melt together in an iron pot over a gentle fire, pitch and gutta percha, and stir well together. Use hot. The addition of a little shellac renders the cement harder when cold. See receipts for marine glues under Cements, page 2510, SUPPLEMENT, No. 158.

(14) E. R. G. writes: I have a lever escapment clock, ticking some two ticks per second, and a fast train watch, ticking somewhere about five beats to a second. Hanging my watch at the head of the bed, with the clock on a box by the side of it, my watch seems to lose a beat every few beats. If the clock is removed the watch beats all right, but on being replaced proceeds to drop the beat again. A. The phenomenon referred to is due to the interference of sound waves.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. B. S.—Impure potter's clay—useful for making tiles and sewer pipe, etc. (see other report).—G. Van S.—It is not iridium, or osmi-iridium, but magnetic iron sand—magnetite.—C. B. H.—Kaolin (porcelain clay) of fair quality.—G. E. E.—It is not quartz but glass.—W. C. H.—It is a fair quality of fire clay—useful for making fire bricks and some kinds of cheap pottery tiles and drain pipe. See column of Business and Personal and Hints to Correspondents.—J. K.—The quartz sample contains much cupreous pyrites and doubtless a little gold. An assay would be required to determine this. The crystals are altered pyrites—not tourmaline—and garnets. Stained quartz has no commercial value.—J. F.—Hornblendic rock—no value.—F. and B.—Partly altered iron sulphide pyrites. The coating is iron oxide. S. & B.—Argillaceous rock containing crystals of iron pyrites.—T. M.—1. Iron pyrites—iron sulphide. 2. (White). Fine white silica—suitable for glass making, scouring, etc. It is probable that coal exists in the vicinity.—W. E. P.—The quartz probably contains a little gold—an assay would be advisible to determine this.—D. K. E.—An impure potter's clay—similar to that of J. B. S., above.—E. W.—Quartzose rock—probably carries a little silver (see answer to W. E. P.)—A. T. B.—It is an ocher—if properly calcined and ground will make a good cheap red paint.—H. E. B. W.—Silicious kaolin—of fair quality—could be used by makers of white ware.—E. M. S.—It is limestone and quartzite. The small fragment of metal is lead.—J. M.—No. 1. Contains a large per cent of argentiferous galena. No. 2. Quartz—probably containing a little silver. These are worth assaying.—H. T.—Magnetic iron sand—contains traces of gold. Box marked, "Tuscon, Az., No. 1" (no letter), contains a sample of quartz rich in horn silver. Box marked "San. Pa." (no letter) contains kaolin of very fair quality.—P. W. P.—It is magnetic iron sand—not iridium ore or emery. We have received letters relating to minerals from J. R., E. P. St. J., E. E. B., W. H. S., L. J., H. R. N.J. G., and J. M. W. The samples referred to have either failed to reach us, or, not having been properly labeled, it is impossible for us to identify them.—C. F. H.—The sediment is chiefly composed of iron carbonate and oxide and carbonaceous matter.—J. C. P.—It is iron sulphide—"fool's gold" in a seam of lime carbonate.—J. C. P. (F. A.)—1. Clay slate bearing a concretionary mass of partly altered pyrites and hornblende schist. 2. Compact pyrites rock. Samples in cubeb box (no label or letter). 1. Crystallized gypsum—used for making plaster of Paris. 2. Chalcopyrite—iron-copper sulphide in limestone gangue. 3. Iron sulphide in quartz. 4. Lime carbonate.—H. T.—Quartzose rock veined with marmolite.—J. M.—Titaniferous magnetite ore. Package marked "Monroe Democrat," is quartz rock carrying much sulphide of iron—possibly auriferous.—I. K.—Clay iron stone of poor quantity.—A. A. R.—1. Quartz and iron sulphide. 2. Fragment of the radiate Favosites goldfusse. 3. A portion of a crinoid or stone lily stem.—S. A. H.—1. A fine argillaceous sand, useful for scouring purposes and in the preparation of some kinds of pottery, enamels, cements, etc. 2. An impure limonite iron ore. 3. Galena—lead sulphide—a rich ore.—J. B. S.—A fair quality of earthy limonite iron ore.—J. R. E.—No sample received.

COMMUNICATIONS RECEIVED.

Theory of Revolving Storms. By J. T. P.
How to Prevent Slipping of Belts. By W. A. E.
On the Fontaine Locomotive. By G. A. T.

[OFFICIAL.]

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FOR WHICH

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

October 11, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1836, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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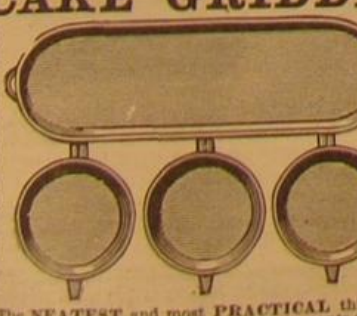

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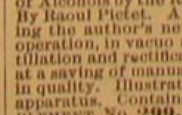

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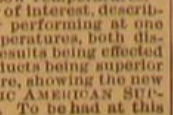

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No. 90,556, issued May 25, 1869, relates to fertilizers and wheat sowers, with gauges opening each way from the center.

No. 104,854, issued June 28, 1870, relates to double acting reversible movement of fertilizer feeder.

No. 105,510, issued July 26, 1870, relates to slide block for adjusting the angle of spring hoes.

No. 105,511, issued July 26, 1870, relates to double rotary fertilizer sower.

No. 137,929, issued April 15, 1873. A peculiar arrangement of locking bars or hoe shifting.

No. 150,328, issued April 28, 1874, relates to improved slide blocks, with attachments.

No. 153,345, issued July 21, 1875, and reissued as No. 8,343 and No. 8,344.

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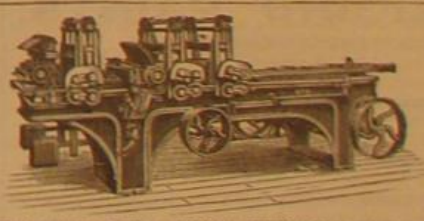

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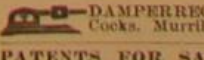

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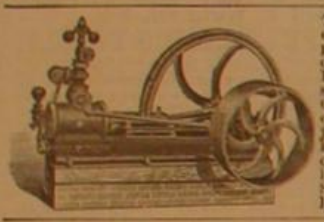

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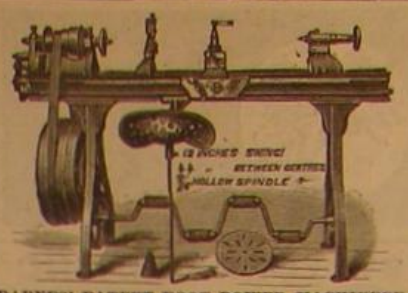

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