SCIENTIFIC AMERICAN

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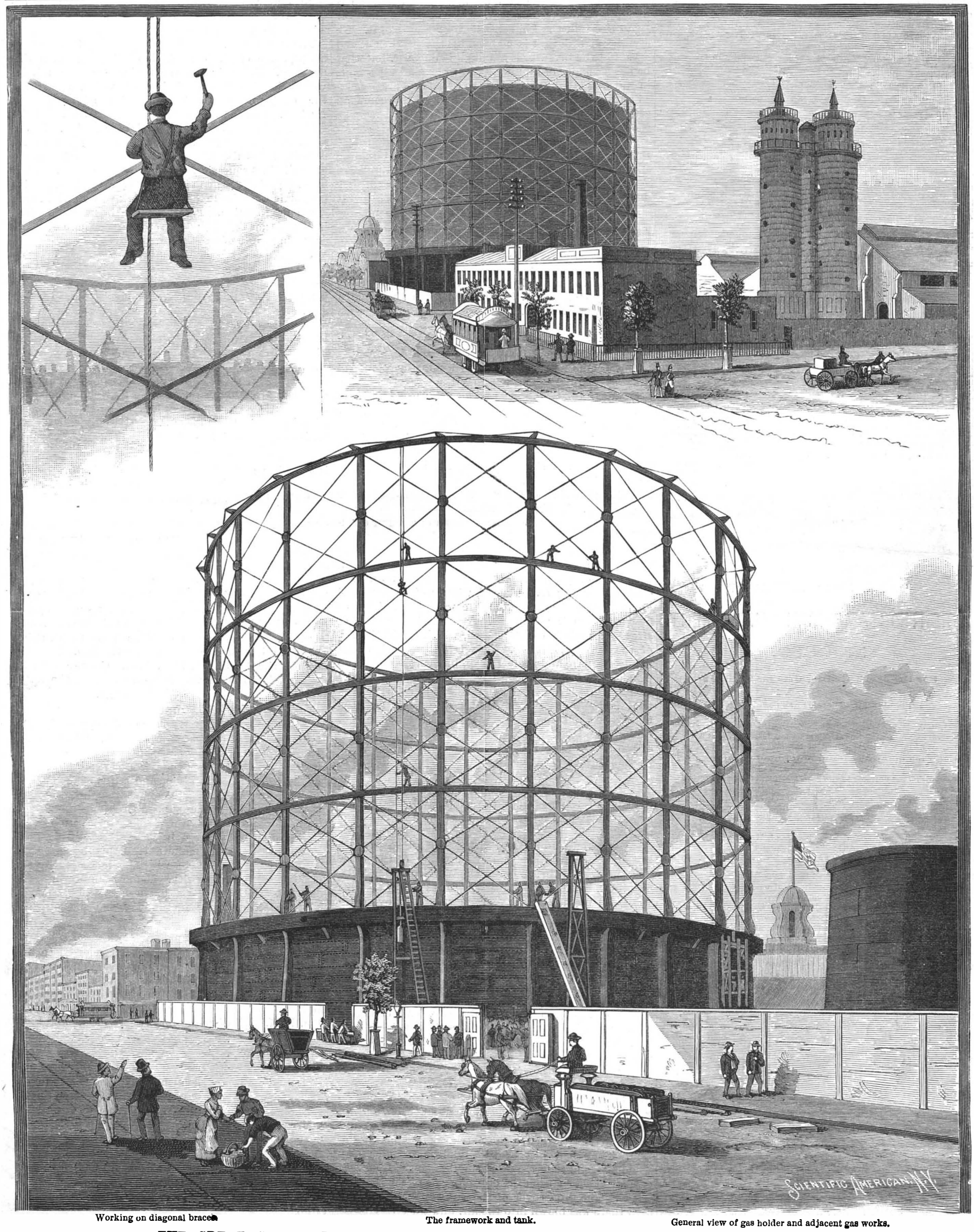

Working on diagonal braces. The framework and tank. General view of gas holder and adjacent gas works.

THE GREAT GAS HOLDER OF THE CONSOLIDATED GAS CO., OF NEW YORK.—[See page 261.]

Scientific American.

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NEW YORK, SATURDAY, OCTOBER 27, 1888.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 669.

For the Week Ending October 27, 1888.

Price 10 cents. For sale by all newsdealers.

BUNGLING CHEMISTS.

An item from Ithaca, N. Y., has recently appeared in the daily press of this city to the following effect:

In the course of conversation at Cornell University Saturday, October 13, Edward Atkinson, the Boston economist, stated that a New England genius has recently discovered a cheap method of dissolving zinc by combining it with hydrogen and producing a solution called zinc water. This liquid, if applied to certain woods, notably whitewood, makes it absolutely fireproof, at a low cost. Mr. Atkinson regards this discovery one of the most important of the age, and one that will surely revolutionize fire insurance, as well as immensely decrease the loss by fire. The invention is kept secret for the present. Only one foreigner—Sir Lyon Playfair, the English scientist—knows of it. He corroborates all that is claimed for the invention, and says that the inventor is a bungling chemist, but that he has a faculty of blundering into the choicest secrets in Nature's laboratory. As soon as patents are perfected and capital interested, zinc water will become an article of commerce.

If this is true, the above discovery would confer a great benefit—the protection of wood from fire. Independent of this, the remarks about a bungling chemist blundering into Nature's choicest secrets are worthy of notice. The chemist who possesses this faculty may well afford to be called bungling. The great discoveries of experimental philosophers were not deductive—inductive work or feeling in the dark has developed the natural sciences; and the investigators of Nature's laws in the atomic realm, the domain of chemistry, have not yet passed the blundering stage. When the deductive methods that led to the failures of old can safely be indulged in, then only can the chemist give up blundering into discoveries. At present such is his dearest hope.

ELECTRIC SUBWAY EXPLOSIONS.

The people of New York having in due course of time reached the conclusion that the network of overhead telegraph, telephone, and electric light wires were in the nature of a nuisance, have for the last two years been endeavoring to put them underground. Already many miles of conduit have been laid, hundreds of miles of wire have been placed in them, and the system is known as the electric subways. In general terms they consist of a conduit of asphalt or other concrete laid along the sides of the streets, four to six feet under the surface. In section, the conduit would appear a solid block, perforated with a number of circular openings about three inches in diameter, for the introduction of cables. These openings are continuous for the length of a section of the subway. It represents a collection of pipes or tubes. Each tube receives a cable containing a number of wires, so that the total accommodation afforded by a conduit with thirty or fifty openings is very great. At each intersection of streets a manhole is constructed, which marks the end of the abutting sections. This is a square pit about five feet square and six feet deep, built of masonry and provided with double iron covers. The conduits lead into this. It is practically impossible to keep the system, including the many miles of conduit and the numerous manholes, perfectly tight. If there is a leak in the gas mains near the conduit, some of the gas is apt to find its way into the manhole directly, or into the conduit openings and through them to the manhole.

It will be understood that as the conduits open into the sides of the manholes, the cables and wires extend across them, as they leave one section and enter the next.

It yet remains to be seen whether the subways attain the solution of the problem of disposing of the overhead wires. Within a few days the Western Union Telegraph Co. has complained that a series of down-town wires, 400 in number, have been ruined by overheating. The steam pipes of the steam-heating company in some way had heated the conduit nearly up to the temperature of boiling water, and the insulation of the telegraph lines was destroyed. Other companies made similar complaints. The matter is to be investigated.

Unfortunately, it also appears that they can be a source of injury to life and property. An explosion occurred on the morning of October 12 in this city, on Broadway near the Bowling Green, which emphasizes a danger to which we are exposed, due to them. A heavy thunderstorm, in which the display of lightning was remarkably vivid, was in progress. The usual electrical disturbances were observed in the telegraph and telephone offices. A number of persons standing in the shelter of the Field building, No. 1 Broadway, witnessed a more remarkable manifestation. They had just heard a violent thunder clap when a second report, almost simultaneous with it, occurred. It came from the opposite side of the Bowling Green. The iron cover of the subway manhole situated there was blown into the air, and the street pavement was disturbed over an area twenty feet square. A flame, four feet in height, was observed to shoot upward from the place at the same instant.

It is said that there is doubt about the cause of the occurrence, but there is little room for surmise. Gas from a leaky main had in all probability found its way into the manhole. As all residents of the city know by experience, the soil is saturated with gas, and every joint in the mains contributes some quota of the ever-present gas. The lighting either caused sparking among the metal work and cables in the manhole or directly inflamed the gas, and the explosion as detailed was the result.

When the steam supply companies began operations in this city, they experienced much trouble from the presence of gas in their manholes. These structures were similar to those of the subway companies. Eventually they were obliged to provide them with ventilating covers, when the trouble ceased.

The subway constructors will probably be forced to adopt some efficient method of dealing with this problem. Perfectly free ventilation of the manholes would involve the admission of water, something the companies owning the cables might protest against. But the wires where they cross the manholes could readily receive some special protection. It appears pretty clear from the accident which we have described that the subways as at present constructed are a distinct source of danger. Where gas accumulates, especially when mixed with air in the explosive proportion, a minute electric spark will light it, and cause a detonation. This principle has been utilized in electric gas lighting; apparently it has here been the actuating cause of a serious explosion.

POSITION OF THE PLANETS IN NOVEMBER.

NEPTUNE

is morning star until the 22d, when he becomes evening star. He stands first on the planetary record of the month, for an event occurs in his history that brings him to his nearest point to the earth. This event is his opposition with the sun on the 22d, at 1 h. P. M. The earth is then between the sun and Neptune. If discoveries are made concerning this far-away planet, they will probably be made when he is in opposition. Neptune rises on the 1st at 5 h. 57 m. P. M. On the 30th, he sets at 6 h. 19 m. A. M. His diameter on the 1st is 2".6, and he is in the constellation Taurus.

SATURN

is morning star. He reaches his quadrature on the western side of the sun on the 11th at 6 h. P. M. He then rises before midnight, and may be found in the northeast, a star of the color of pale gold, shining with a serene light. Saturn rises on the 1st at 11 h. 37 m. P. M. On the 30th, he rises at 9 h. 38 m. P. M. His diameter on the 1st is 16".8, and he is in the constellation Leo.

MERCURY

is morning star. He reaches his greatest elongation or most distant point from the sun on the west on the 17th, and will then be visible to the naked eye as morning star, about 8° north of the sunrise point, rising about an hour and a half before the sun. Mercury rises on the 1st at 6 h. 16 m. A. M. On the 30th, he rises at 5 h. 53 m. A. M. His diameter on the 1st is 9".6, and he is in the constellation Virgo.

VENUS

is evening star, and is fair to see as she approaches the earth, traveling eastward from the sun. The observer will recognize her at a glance in the southwest soon after sunset, about 8° south of the sunset point. She sets on the 1st about an hour and a quarter later than the sun, and on the 30th about two hours and a quarter later than the sun. An interesting event marks her progress. She is in conjunction with Jupiter on the 1st at 4 h. 18 m. P. M., being 1° 27′ south. Both planets make a brilliant appearance in the constellation Scorpio, which is increased by the bright stars in the vicinity. Venus sets on the 1st at 6 h. 11 m. P. M. On the 30th, she sets at 6 h. 45 m. P. M. Her diameter on the 1st is 12".2, and she is in the constellation Scorpio.

JUPITER

is evening star. As has already been referred to, he, moving westward toward the sun, meets Venus moving eastward from the sun, and the two brightest planets in the system are seen side by side. Jupiter sets on the 1st at 6 h. 19 m. P. M. On the 30th, he sets at 4 h. 49 m. P. M. His diameter on the 1st is 30".6, and he is in the constellation Scorpio.

MARS

is evening star, and is moving eastward or retrograding. His lessening size will soon make it difficult to follow the course of the ruddy planet. Mars sets on the 1st at 8 h. 3 m. P. M. On the 30th, he sets at 7 h. 59 m. P. M. His diameter on the 1st is 6".2, and he is in the constellation Sagittarius.

URANUS

is morning star. He rises on the 1st at 4 h. 44 m. A. M. On the 30th, he rises at 2 h. 58 m. A. M. His diameter on the 1st is 3".4, and he is in the constellation Virgo.

Venus, Jupiter, Mars, and Neptune are evening stars at the close of the month. Saturn, Mercury, and Uranus are morning stars.

Trade Apprenticeship for Boys.

A basis for criticism of the conditions of modern life is found in the unwillingness of young men to learn trades. Some element of social degradation seems to be found in the use of the hands; pure brain work is the coveted goal of the many.

It is pleasing to note that this prejudice meets with enlightened opposition. For generations past the sons of the German emperors have learned some mechanical trade. In the library of the late Emperor William at Potsdam, visitors are shown a chair made by him when a youth, for his father.

The sons of John Bright, the famous English parliamentarian, set a good example to the rising generation. Their training is thus set forth by the *Christian at Work:*

"Philip Bright, desiring to become a first class machinist, served a regular course in Petrie's iron foundry, to which he carried his breakfast-can like other plain workmen, and in which he put himself on a par with other honest hands, acting as naturally as if he were one of them himself. His brothers—Leathem, now a member of Parliament, and John Albert—were put through the drills at the mills on the principle that they too must undergo their share of work like other people. Such an example of common sense and democratic equality is in the highest degree commendable. The great problem of the future will be to unite education and manual labor. Many persons seem to imagine that they are forever inconsistent and antagonistic, and that, therefore, the public schools are training young men to live by their wits rather than by useful and productive trades. Whether the head and the hand can be cultivated at the same time, and in a happy proportion, remains to be seen. John Bright's sons would by their example indicate that they can, but then they are capitalists as well as laborers."

Another instance within the experience of the writer will serve to still further point the moral. Over twenty years ago, very early one morning, he met a boy of 17 or 18 years of age hurrying through the street, dinner pail in hand, accoutered as a workman. He was recognized as the son of an acquaintance. Curious to know what brought him out in such guise at so early an hour, the writer stopped him, and inquired whither he was bound. The boy assumed a look of manly pride as he announced that he was going to work at the Morgan Iron Works as a regular apprentice. The foreman, he added, was very exacting with the apprentices and required them to begin their work on time with the journeymen. The father, who had sent the young man to take his place among the three or four hundred apprentices employed at the once famous works, acted with wisdom which was proved by the course of events. He is now connected with one of the most influential and successful daily papers of this country. The son to-day is in full charge of the mechanical department of the business, and is qualified by his training at the old Morgan works not only to take charge of the complicated machinery of the modern press room, but also to pass an enlightened judgment on improvements in the art, and has himself invented a number of valuable improvements in the printing press. He cannot regret his long days of apprenticeship, and it is not too much to say that it is they which have won for him his truly honorable and useful position, one which the constant sense of usefulness and competence must make doubly dear to him.

The Proposed Court of Patent Appeals.

An interesting speech was lately made in the House of Representatives by the Hon. George E. Seney, of Ohio, in which some of the objections to the establishment of the new court were ably presented. We quote as follows:

The pending bill provides for an appeal from the Commissioner of Patents to the court of patent appeals in a multitude of cases. In other words, the bill authorizes an appeal to the court of patent appeals from nearly every decision the Commissioner of Patents is required to make, and in addition to this it authorizes a further appeal in the same cases to the Supreme Court of the United States.

It is true that upon the right of appeal to the Supreme Court two limitations are imposed. The first one is that in the case sought to be appealed the amount involved shall be $100,000 or more, exclusive of costs. To what extent, if any, this limitation upon the right of appeal will keep patent causes out of the Supreme Court need not now be discussed. If the jurisdiction of the Supreme Court is to depend upon the fact whether $100,000 or a less sum is involved in a given case, by whom is this fact to be ascertained, and if by the Supreme Court, how much more of its time would be required to hear and determine the case upon its merits? Under the second limitation an appeal is authorized when the Supreme Court deems the questions involved to be sufficiently important, or doubtful, to justify an appeal.

The provisions of this bill make it possible for parties to get into the Supreme Court with their patent cases and to have them heard upon the question as to their right to appeal them, if not upon their merits. In what respect, then, will the Supreme Court be relieved in patent causes if this bill be made a law?

The court of patent appeals is to have appellate jurisdiction from the circuit courts of the United States and from the Supreme Court of the District of Columbia in all cases touching patents, copyrights, trade marks, and labels, without regard to the sum involved in the controversy, and from the judgment of the court of patent appeals an appeal may be taken to the Supreme Court of the United States, subject to the two limitations mentioned but a moment ago.

It is not unreasonable to assume that in case the court of patent appeals be established, all the causes involving important or doubtful questions, and all of the causes involving interests of the value of $100,000, will find a place upon the Supreme Court docket, and those of a different character will be on the same docket for hearings as to the right of appeal. Instead of relieving the Supreme Court by reducing the number of cases upon its docket, this bill, in case it becomes a law, will, according to my understanding of its provisions, increase the labors of that court. . . .

The patent appeals court, if established, ought to be so composed that its decisions reviewing the decisions of a high tribunal like the circuit court would be, by reason of the ability and learning of its judges, acceptable to patent litigants, if not in all, then in much the larger number of cases. This would make the patent appeals court, to a very considerable extent, a court of last resort, and therefore the appellate jurisdiction of the Supreme Court could be confined to a few exceptional cases.

But to add one more to the present number of our Federal courts seemingly for no other purpose than to give a certain class of litigants one more chance would be very unwise.

More than two trials of the cause upon the facts and the law—the first in the original jurisdiction and the second in the appellate jurisdiction—are not allowed under the judicial system in force in the States, and hitherto in the United States, but patent right men, by the pending bill, ask for three trials in their cases, and to insure three trials they insist that two courts shall be created for their exclusive use. They would have us make a court out of a subdivision of the Department of the Interior and confer upon the commissioner in charge the powers of a court and a judge. And for their second court they insist we shall establish a court of patent appeals.

The bill, it will be observed, divides patent right controversies into two classes. Of those touching patents, copyrights, trade marks, and labels, the circuit courts are to have original jurisdiction, the court of patent appeals appellate jurisdiction, and the Supreme Court appellate jurisdiction, or, in other words, three trials are to be had in such patent causes, one in each of these three courts. Of the other class, original jurisdiction is in the Commissioner of Patents, acting as a court and judge; after him in the court of patent appeals, and after it, in the Supreme Court, or, in other words, a trial before the Commissioner, and afterward two more trials, one in the patent appeal courts and another in the Supreme Court of the United States.

The bill gives to this court a place in our judicial system above the United States circuit courts. The judgments of the circuit courts in patent cases are to be reviewed by the court of patent appeals, and this makes the circuit court the inferior tribunal. If a court lower than the Supreme Court and higher than the circuit court—an intermediate court, if you please—be essential in our judicial system, its jurisdiction ought not to be limited to the trial of patent causes. The jurisdiction of such a tribunal ought to extend to all causes in which the Supreme Court has appellate jurisdiction under existing laws.

And then, again, a court whose time is to be largely employed in reviewing the opinions of the Commissioner of Patents ought not to stand in our judicial system next in rank to the Supreme Court of the United States.

The bill provides that the court of patent appeals shall hold its sessions at the seat of government, and because of this its jurisdiction would extend into and over every State and Territory of the United States. Established in Washington, this court would be invested with power to bring before it, from all parts of this vast country, those of our countrymen who may have contentions under our patent laws. The jurisdiction of this court is to be wholly appellate, and whether it be from the rulings of the Commissioner of Patents or from the judgments of the circuit courts of the United States, it is to be exercised at Washington, and at no other place. Whatever may be thought of the other objections we have urged to this bill, the one now before us presents the question as to whether it is best to center at the Federal capital more of the judicial power of the government or diffuse it throughout the States.

Against all legislation which tends to centralize the power of the government, whether executive, legislative, or judicial, the representatives of the people ought to take a resolute stand.

The Constitution vests the judicial power of the United States in one Supreme Court, and in such other inferior courts as the Congress may from time to time ordain and establish. While it is eminently proper that the Supreme Court should hold its sessions at the seat of the general government, it is equally proper that the courts established by the Congress should hold their sessions nearer to the homes of the people. . . .

This bill, in proposing to establish another court at Washington, with a jurisdiction coextensive with our territorial area, antagonizes the better interests of the people, and for this reason, if for none other, it ought not to become a law. The present laws which give to the circuit courts original and to the Supreme Court appellate jurisdiction in patent controversies need no change, and of the changes suggested, that of creating another court and putting it between these two high tribunals, to review the one and then be reviewed by the other in patent causes, to my mind is utterly destitute of merit.

Under Ground Four Miles to the Theater.

In some countries it would seem strange for a party going to see a theatrical entertainment to make a dive into Mother Earth, travel four miles under the mountains, and then dart up to the surface within a stone's throw of the ticket office; but it is after such a fashion that some of our people go to their regular dose of drama, comedy, and tragedy.

Recently a party of ladies and gentlemen of the town of Sutro, who wished to see "The Two Johns" at the opera house, took the subterranean cut. Starting at the mouth of the Sutro tunnel, at their own doors, they came up the tunnel to the C. & C. shaft, a distance of a little over four miles. Dismounting from the cars, they then boarded the cages in the shaft and were shot upward to the surface, a vertical distance of 1,640 feet.

This way of going to the theater is as much fun for our ladies as going to a picnic. It is really a pleasure, but until a lady has become somewhat accustomed to life in the mines, it requires a little nerve. It is fine and cool the whole four miles under ground. The cars will not soil even the most delicate dresses of silk and satin, therefore there is no trouble of changing clothing. In her room at the mouth of the tunnel a lady may stand before her mirror and give the finishing touch to flower or feather, and in just such shape as she turns from her glass she is shot up to the surface in this city, ready to take her seat in the box in the opera house.—*Virginia City Enterprise.*

Utilization of Old Tins.

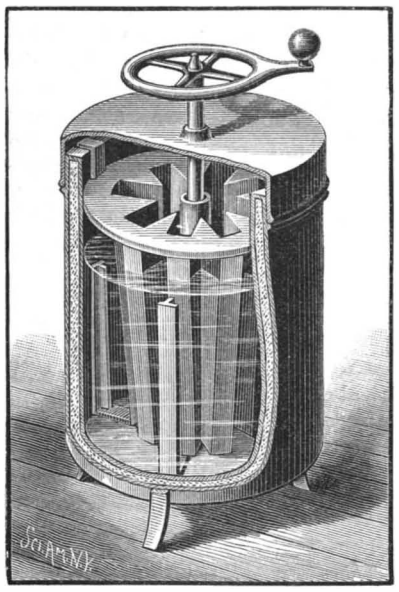
A number of people recently gathered at the Columbia Rolling Mill, Fourteenth Street and Jersey Avenue, Jersey City, at the formal opening of the mill. The industry is a novel one, being the manufacture of taggers' iron from old tin cans and other waste sheet metal. This iron has heretofore been manufactured almost exclusively in Europe, and the Columbia Rolling Mill Company is the only American company which turns out the product in large quantities. The process is simple. The tin cans are first heated in an oven raised to a temperature of about 1,000°, which melts off the tin and lead. The sheet iron which remains is passed, first, under rubber-coated rollers, and then chilled iron rollers, which leaves the sheet smooth and flat. After annealing and trimming, they are ready for shipment. The tin and lead which is melted from the cans is run into bars, and is also placed upon the market. All the raw material used is waste, but the sheet iron turned out is said to be of good quality. It is used for buttons, tags, and objects of a like nature. The material used costing little, and the demand for taggers' iron being considerable, it is thought that this is a good opportunity to build up another American industry.

Recovery of a Long Lost Tapestry.

"When Maguerite of France was married to Victor Amadeus of Savoy, she took with her to Italy twenty pieces of the very finest Gobelins tapestry, illustrating classical legends," says *London Truth.* "This unique tapestry, which was of immense value, disappeared mysteriously when Napoleon invaded Italy, for it had been hidden away in case the French might think proper to carry it off, which they would certainly have done. It had been so carefully concealed that, after some years, when calm was restored, it was found impossible to discover it, and the two officials who had put it away were both dead. The tapestry had been almost forgotten till about a month ago, when the Marquis Villamarina, the master of the royal household, was making a thorough investigation of the palace at Turin from roof to cellar, and behind some huge chests in a storeroom in the highest story he found a secret chamber, in which was concealed the long lost tapestry, and it had been very little injured by its hundred years of hiding. King Humbert has ordered that the tapestry is to be carefully repaired and cleansed, after which it is to be sent to Rome and hung in the Quirinal in the apartments which the Emperor William is to occupy during his visit next month."

A SIMPLE HOUSEHOLD FREEZER.

An improved freezer, specially adapted for making ice in small quantities for household use, or for cooling bottles of wine or other substances, is illustrated herewith, and has been patented by Mr. Theodore L. Delpy, of Paris, France. It consists of a receptacle adapted to hold a freezing liquid, and having double walls filled with a non-conducting material, an upwardly projecting pin in the bottom of the receptacle being fitted with a sleeve secured to a vertical shaft, the upper end of which passes through a suitable bearing in the cover. The outer end of the shaft has a hand wheel, and from the sleeve at its bottom extend radial arms provided with upright T-shaped beaters. Centrally in the receptacle is held a vessel, preferably star-shaped in cross section, the vessel being supported by L-shaped arms resting on the top edge of the receptacle. In the central vessel is held a tube, through which passes the sleeve and vertical shaft, so that the latter can revolve without revolving the vessel. The outer receptacle being supplied with a proper quantity of any suitable freezing liquid, such as sulphate of soda and hydrochloric acid, or other mixture, and the inner vessel holding the water or other liquid to be frozen, the operator turns the hand wheel, whereby the freezing mixture is agitated by the beaters and exerts its freezing power on the inner vessel.

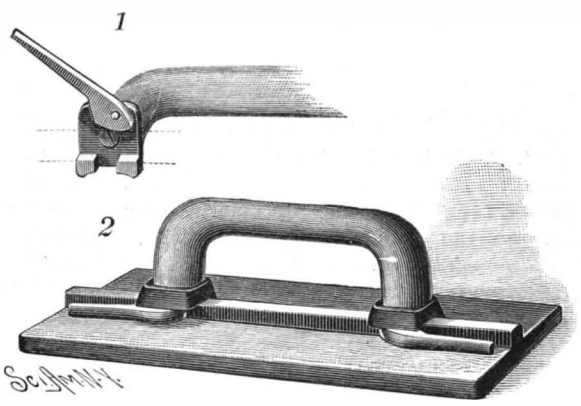


DELPY'S FREEZER.

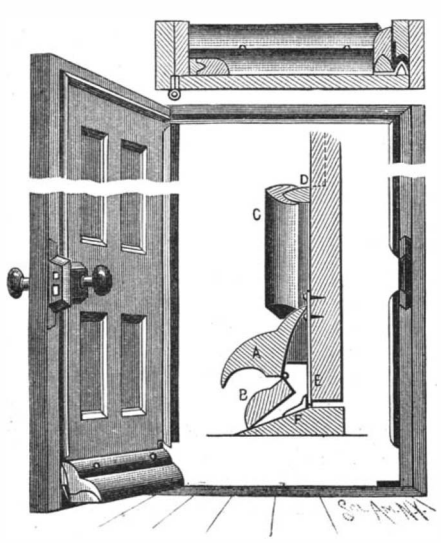
For further information relative to this invention address Mr. L. Dermigny, No. 126 West 25th Street, New York City.

AN IMPROVED MASON'S FLOAT.

A mason's float and handle so made that they can be easily and quickly put together and taken apart, the blade being held firmly by the handle without the use of nails, is illustrated herewith, and has been patented by Mr. George Kautz, of No. 236 Central Avenue, Albany, N. Y. A central longitudinal ridge is formed on the blade of the float. To each end of the handle a cap is rigidly secured by a screw, each cap having two foot lugs on one side, as shown in Fig. 1, and on the other side a screw or pin for pivotally connecting a cam lever to the cap. There is a space between each cam and the lugs, forming a recess for the reception of the longitudinal ridge formed on the blade of the float,



KAUTZ'S MASON'S FLOAT.



BURCAW'S WEATHER STRIP.

the latter being firmly secured to the handle by turning the levers to the position shown in Fig. 2. The arrangement of the parts prevents any strain on the blade of the float, which is thereby prevented from warping, and may be used until worn out, when the handle may be used on another float of similar construction.

Alaska.

Governor Swineford, in his report, states that the coast line of Alaska, 18,211 miles, is nearly twice the combined Atlantic and Pacific coast lines of the United States. The market value of the Alaska fisheries for last year is estimated at $3,000,000. A thousand salmon, averaging ten pounds each, have been taken in Sitka Bay in a single haul. The seal fisheries yield to the government $317,500 annually, or enough to pay 4 per cent on the amount paid Russia for the country. A single island is said to be practically a mountain of ore, and to contain mineral wealth enough to pay off the whole of our national debt.

The fish commission steamer Albatross sailed into Puget Sound early last month, after an interesting cruise in Alaskan waters. Deep-sea soundings were made to verify those made by Commodore Belknap in the Tuscarora while locating a line for a Japanese cable in 1874. Capt. Tanner found even greater depths in short distances than the Belknap soundings. At one point 3,800 fathoms was reported. In three miles the ocean bottom was found to sink from 40 to 1,100 fathoms, and in twenty miles at another point from 500 to 2,100 fathoms, the ocean cañon being long and deep. Several new varieties of fish were brought to the surface by trawls and by hook and line from these ocean depths. One had a head like a shark, with large teeth, but a body like an eel or a snake, tapering to a point as fine as a knitting needle. Some fine specimens of shrimps were secured at points near the coast. A quantity of fine clams, which are used for bait by fishermen, were planted in a small inlet west of Oonalaska. From this port the Albatross sailed back east of the Aleutian Island group and down toward Kodiak. Soundings and dredgings were made all along, and the 100 fathom curve located. Great numbers of codfish were secured. The waters in that region are filled with cod, those at a distance from the coast being much the best. Some investigation of Puget Sound fish will, it is understood, be made by the Albatross, and then the plan is to pass the winter months off the Santa Barbara Islands and the coast of Lower California.

AN IMPROVED WEATHER STRIP.

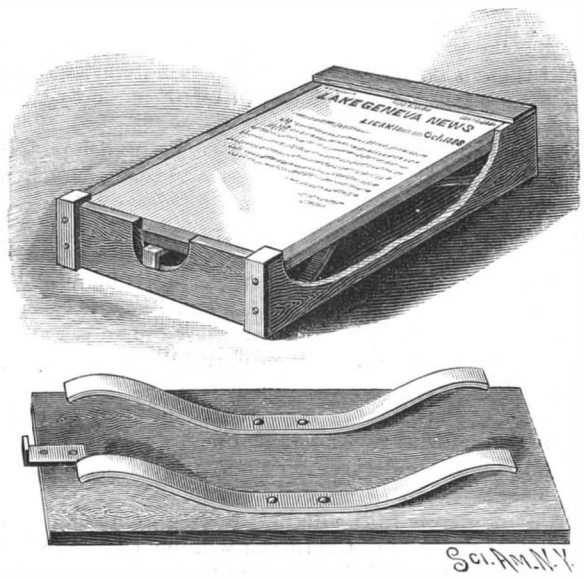
A weather strip especially designed to prevent draught all around a door is illustrated herewith, and has been patented by Mr. Franklin P. Burcaw, of Hazleton, Pa. The door is provided at the bottom with a fixed moulding, A, having a groove in its bottom, in which fits a corresponding strip, B, hinged in a recess in the inner edge of the moulding, a fibrous or leather strip being secured to the approaching edges, A and B, to close the air space between the hinges. A spring, E, is secured at one end of the door, projecting downward at its free end, and adapted to hold the strip, B, in the bottom of the moulding, A; but when the door is closed, an arm of this spring strikes against the lug, F, pressing the spring toward the door, so that the strip, B, swings downward until it rests on the bottom of the door casing, preventing any draught from entering the door. Two strips of moulding, C and D, are used on the edge of the door and on the casing, a central offset or tongue of one strip fitting snugly into a correspondingly shaped groove in the other strip. A metallic V-shaped strip is secured by its flange to the door casing near the lock, a corresponding strip secured to the door fitting thereto, these strips forming a continuation of the mouldings, C and D. The side and top draughts are thus prevented by the mouldings of the casing fitting into the corresponding mouldings on the door, and when the door is closed, the bottom draught is prevented by the hinged strip, B.

AN IMPROVED RAILROAD TIE.

A metallic railroad tie, recessed near its ends to receive the base portions of the rails, together with locking blocks or keys to hold the rails both sidewise and downward to their places, is illustrated herewith, and has been patented by Mr. Israel G. Howell, of Hopewell, N. J. In addition to the central transverse recess in each end of the tie, to receive the base portion of the rail, there is a further extension of such recess to be filled by a locking wedge or block on each side of the rail, this locking wedge being entered within an overlapping lip at each end of the main recess. These locking blocks bear upon or over the lower flanges of the rails and up against their webs. To prevent the locking blocks from working loose, saddles are fitted over them, lying in grooves in the upper faces of the blocks, the saddles being held in place by pins passed through the ties, as shown in the sectional view. With this tie the rails can be readily taken up and replaced, and independent chairs may be dispensed with.

AN IMPROVED BINDER.

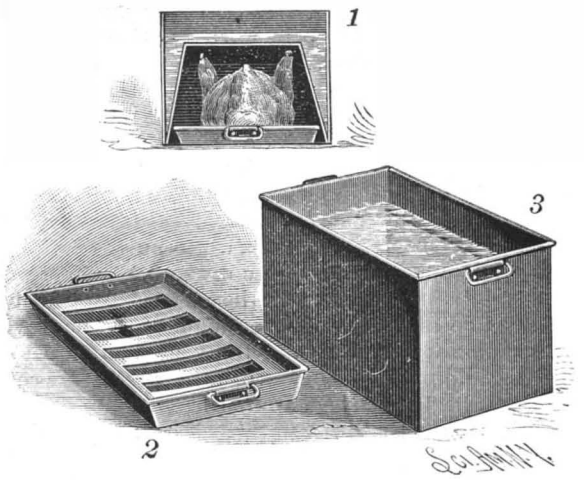
A binder for temporarily holding a number of sheets of paper in the form of a pad is illustrated herewith, and has been patented by Mr. Asa K. Owen, of Lake Geneva, Wis. A shallow box forms the body of the binder, a ledge projecting inwardly over one end of the box, and right-angled plates attached to the box projecting inwardly over its other end. To the inner surface of a smooth-faced support fitting within the box, and adapted to move freely up and down, two bow springs are attached, which rest upon the bottom of the box and press the support upward. To the under surface of the support, at one end, is attached a finger piece, which extends through a semicircular notch in the end of the box. The sheets of paper are placed between the ledge and the support at one end of the box, by simply pressing down upon the support, the springs clamping the paper in position, after which the opposite end is depressed and the other end of the paper similarly placed. Depressing the lower end of the support by means of the finger piece facilitates the removal of the sheets of paper as desired.



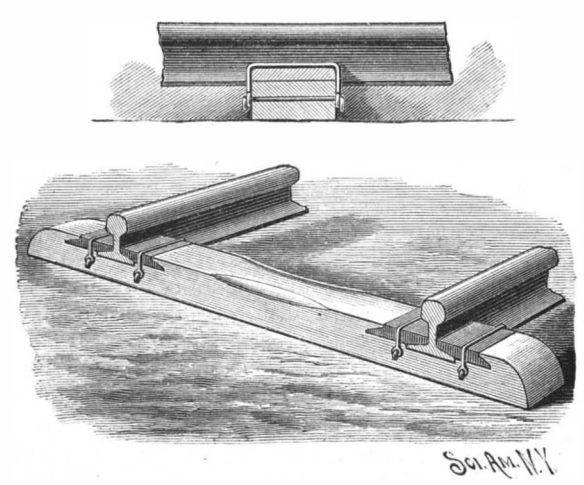
OWEN'S BINDER.

AN IMPROVED BAKE PAN.

A pan for use in baking, in the use of which the article to be cooked will be suitably supported on a rack and practically inclosed by water, is illustrated herewith, and has been patented by Miss Bettie H. Bicknell, of Loudon, Tenn. In a shallow pan, as shown in Fig. 2, is placed a wire or other suitable iron frame, held up sufficiently to allow the bottom of the pan to be covered with water. The cover is shown in Fig. 3, being formed of a deep inverted pan or box, tapered toward its upper end, and with an open top, forming a large water space, as shown in section in Fig. 1. This invention is designed to obviate the necessity of boiling meats or fowls before baking them, thus shortening the process of cooking and fully retaining the juices and flavors of the articles cooked.



BICKNELL'S BAKE PAN.



HOWELL'S RAILROAD TIE.

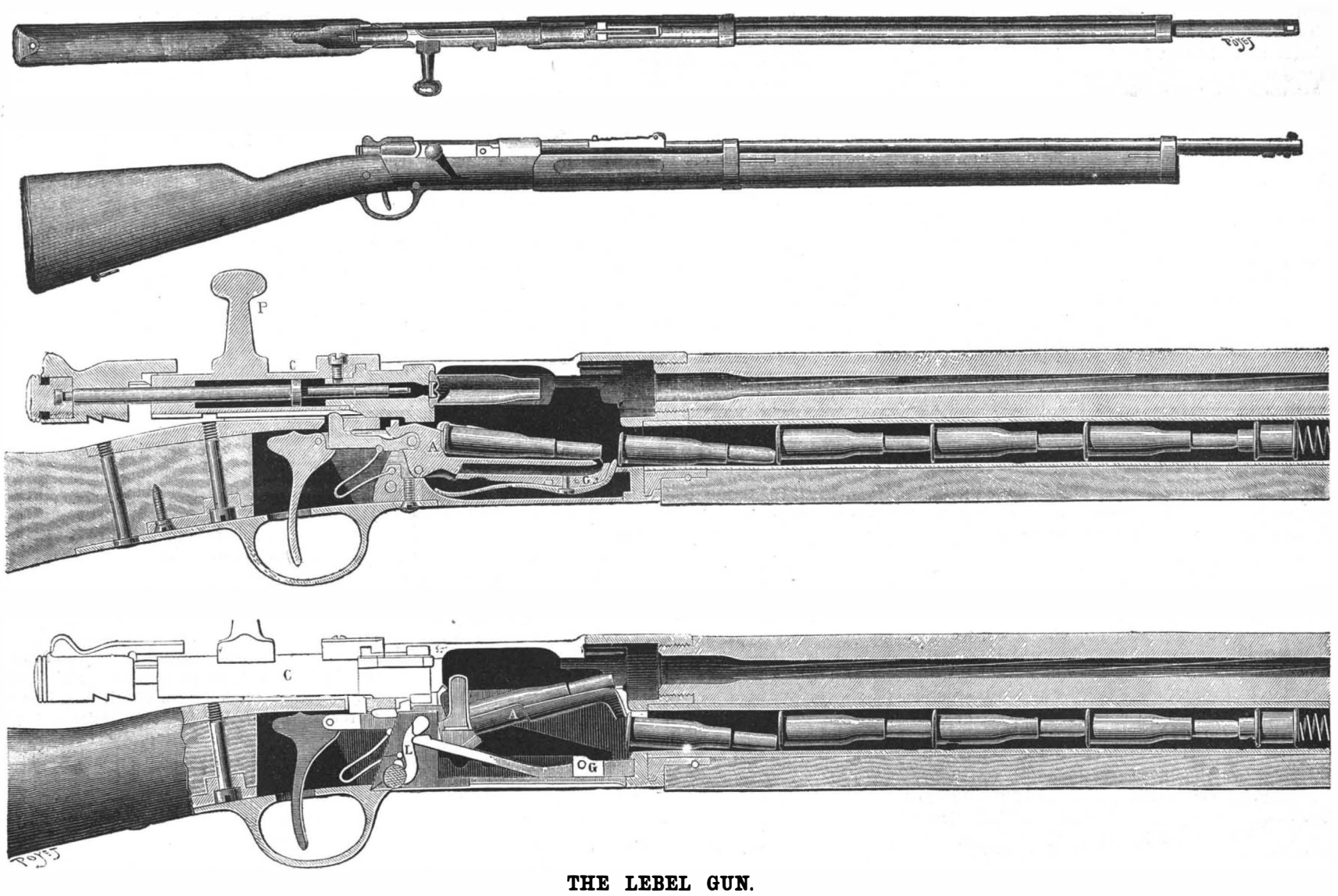
THE LEBEL GUN.

The French Minister of War has just published a description of the Lebel gun. This publication, designed for the instruction of the troops, has caused a certain amount of feeling among the public here and there, and some of the newspapers have denounced, as a grave fault, what they style a divulgation of the secrets of the national defense. The fact is that a wrong has been done to a legend only. The new gun of our infantry is in every respect an excellent weapon, but there is nothing mysterious about its mechanism, nor even anything new, for it is simply a modification of the Gras repeating rifle of the model of 1885, which, in turn, is derived from the Kropatschek system used in the French navy ever since 1878. The essential modification is that of the caliber, which has been reduced from 0·4 to 0·3 inch, thus permitting of a great diminution in the weight of the ammunition, and of obtaining, at the same time, much greater range and precision through the use of the new powder. We may mention, too, the better distribution of the resistance to the recoil, which is exerted symmetrically upon two bolts, instead of, as formerly, upon the re-enforce of the breech lever, that is to say, on one side.

As for the principle of the system, we may remark, by comparison, an analogy of the Lebel gun with the German repeating rifle of Mauser. In both weapons, the magazine consists of a tube contiguous to the barrel, in which the cartridges are placed end to end. A spiral spring pushes these to the rear into a trough, A, which, in rising, causes them to pass from the magazine into the breech end, when the movable breech is set in motion. When the trough, A, rises, a catch, G, projects behind the last cartridge remaining in the magazine. Finally, a lever, L, terminating in a button, serves to stop the action of the repetition mechanism. When this lever is shoved forward, the trough remains raised, and the weapon then operates like a shotgun into which the cartridges are introduced into the breech end by hand. The closing and percussion mechanism is that of the Gras gun.

Without its bayonet, the new gun is 4¼ ft. in length, and weighs 9 lb. when empty. All its details have been elaborated by a special commission, whose labors have provided us with a fire-arm which has no equal among any of the military powers.

This is the whole truth. It is well enough for us to have a feeling of satisfaction and confidence, but the fact must not be overlooked that the art of war is making continuous progress, and that new improvements are soon to be looked for. Inventors are already occupying themselves with the idea of utilizing the force of recoil, so that the gun shall, of itself, reload and shoot. We shall thus obtain a genuine "ball pump," which the marksman will only have to point, just as one directs the nozzle of a fire hose. There are already mitrailleuses constructed upon this principle, the firing of which, entirely automatic, is regulated at will from one shot per two minutes up to six hundred shots per minute, but it requires at least two men to manage them. If, as seems probable that it will, it becomes possible to render them thoroughly portable, it will prove the signal of a new evolution in the equipment of armies.—*L'Illustration.*



THE LEBEL GUN.

An English View of English Ships and Guns.

A correspondent of *Engineering*, "Gunner," says: "Our ships are now showing their points—some won't steer, others won't go astern, and the Northampton has narrowly escaped being rammed by the Benbow as the Sandfly did of diving to the bottom. As to our guns—which we were told in 1884 were to be made in a manner superior to those of other nations—there have been since then a succession of failures. This is not surprising, when we observe their great length, insufficient rigidity, and the enormous strain thrown upon them by driving banded projectiles through a bore of considerably smaller diameter than the copper bands upon these missiles. Surely it is not necessary to make the gun do the work of the lathe, and instead of the small strain of rotating the projectile to add the bursting strain caused by rifling the missile, and then rotate it by the heels, leaving the front free to split the inner tube or knock the muzzles off the guns, as in Active, etc." The *Admiralty Gazette* calls attention to the fact that the Armstrong guns, some of which are now obsolete, cost England nearly twelve and a half million dollars (£2,500,000) before their defects were recognized. Of guns and rifling it says: "We have no more favorable experience than that afforded by split tubes, muzzles blown off in proof or on service, and half a dozen minor defects. Yet we go on spending money as if every disputed question had been set at rest and solved for all reasonable time."

Conversion of a Paddle Steamer into a Screw.

The London and Northwestern Railway Company, some months since, placed their paddle wheel steamer Duchess of Sutherland (built in 1869) in the hands of Messrs. Laird Brothers for conversion into a twin screw steamer, with the expectation that her efficiency for their cross-channel cattle trade would be improved, and that considerable gain in economy would result from the introduction of more modern machinery. The work has now been completed, and the vessel lately made a trial outside the port, attaining, says *Engineering*, a speed of 14½ knots, the engines developing 1,400 horse power. The alteration effected may be briefly described as follows: The old machinery, paddle wheels, and boxes have been removed, but the forward and after sponsons and their houses on each side have been retained and connected, the houses forming quarters for the ship's officers, storerooms, etc., the old paddle wheel space decked over and formed into a large additional space for cattle. The necessary alterations have been made about the stern of the vessel, and stern tubes and brackets fitted, and the arrangement of engine keelsons, bulkheads, coal bunkers, etc., have been modified to suit the new machinery. This consists of two sets of triple expansion engines having cylinders 16½ in., 26 in., and 41 in. in diameter, with a stroke of 2 ft. 6 in., and working at 150 lb. pressure, steam being provided by two double-ended cylindrical steel boilers, each set of engines driving its own propeller. The results of the alteration are strikingly worthy of attention, and may be summed up as follows: The carrying power of the vessel has been increased by about 190 tons, large additional deck space for cattle gained, while the net register tonnage has been reduced by 247 tons. The speed has been considerably increased, and the consumption of fuel will be reduced by 60 per cent. This small consumption has been successfully maintained over a period of more than six months by the Olga, built last year by Messrs. Laird Brothers, and fitted with similar engines.

Japanese Coal Mining.

The principal coal mines in Japan are situated on the island of Takashima, outside the harbor of Nagasaki. They form one of the principal centers of coal supply in the East, and have now been worked by a lessee of the government's with all the more recent and improved appliances for about sixteen years past. According to a recent official report, 2,500 miners are engaged, the total population of the island being 10,000. The remainder is composed of fishermen, officers, mechanics, surface laborers, and a floating population of hangers-on to the miners. The latter have daily rations sold at fixed prices. These consist of rice, vegetables, pickles, tea, fish, beef soup, and occasionally beef, the total daily cost being under 10 cents. The daily earnings are 22 cents to 24 cents, and the total reductions for necessary expenses are altogether 14 cents, leaving between 8 cents and 10 cents clear, while the scale of dietary is far above the average of the same class elsewhere in Japan.

Married and unmarried men live apart. The latter live in buildings containing living rooms, dormitories, and eating rooms. The kitchens and offices are all apart from the dwellings, with special drainage into main conduits. The rooms are warmed by large fireplaces, and ventilated and lighted by windows fitted with sliding Venetian shutters. The area allotted to each man in the living rooms is about 500 cubic feet of air space. The married people live in separate apartments, giving about 2,000 cubic feet of air space. From July to October the island is put into a state of semi-quarantine against all outside communication, partly with a view to prevent the importation of epidemics, but also to prevent the sale of deleterious foods brought from the mainland. All such food as seaweed, unripe fruit, uncooked vegetables, shellfish, etc., is strictly forbidden, as is also the drinking to excess of intoxicating liquors.

A Novel Swimming Dress.

A swimming dress, resembling a diver's dress, and made of double India rubber, has, according to a foreign contemporary, been adopted in the German navy. On the chest is a valve through which air is blown into the interior of the dress, which covers the whole body and leaves only the face free. To prevent the swimmer from being too much tossed about by the sea, the space round the chest is especially large. The swimmer wears a belt, which divides the dress into two parts, to prevent a too great loss of air if the dress were torn about the legs, and consequent difficulty in swimming. The swimmer wears shoes with leaden soles to secure his equilibrium, and for his defense a dagger, which is fastened to the girdle. The swimmers are to be employed for the blowing up of mines and hostile craft, and are provided with a box containing an explosive charge, which they have to fasten to the mine or craft, and ignite. Before the explosion occurs they are out of the reach of danger. The swimming dress has been already tried in Germany. During the attack on the harbor of Kiel on August 29, swimmers were dispatched from the ironclads to destroy the mines closing the port.

The San Diego Flume.

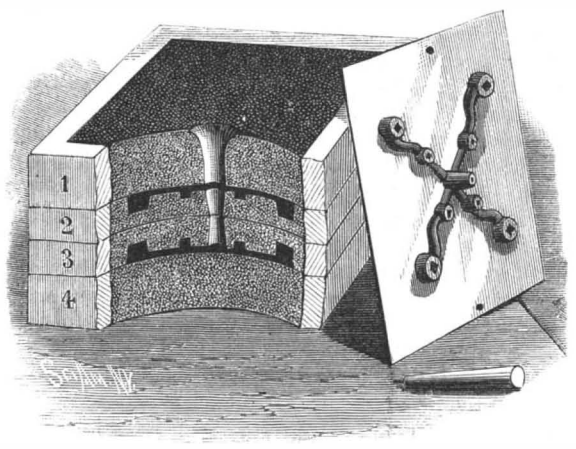
The total length of the flume, when finished, will be thirty-five and three-quarter miles, and the thirty-fourth mile is now completed. The redwood came from Humboldt and vicinity, in Mendocino County. Redwood was used exclusively in the box of the flume. It was strictly clear selected redwood, without knots or sap. The work of the contractors began early in June of last year. On June 27 the first load of lumber was hauled out. An idea of the gigantic character of the work that has since been done can be gained by noting the number of animals and men that were employed. As high as 500 head of horses and mules have been in service at one time, being driven in eight and ten horse teams. During a good portion of the time, sixty teams have been traveling back and forth hauling the lumber. Besides the teamsters, from 75 to 125 men were constantly employed in the work of construction. With the yard hands and other helpers, it is safe to say that 200 men were constantly employed in the various departments of the work. Mr. Carle estimated the amount of lumber used in the flume at 9,000,000 feet. This is a very conservative estimate, and in all probability considerable more was used. The vastness of this amount of lumber can better be impressed on the mind of the reader by some comparative statements. Had this lumber been all loaded on wagons at one time, it would have required 3,000 wagons and 25,000 horses to haul it. The string of teams, if drawn into line one after the other, would make a procession over fifty miles long; the amount of lumber used in the construction of the flume would be sufficient to erect over 200 large two-story residences and would load nearly forty large ships. A tree that will yield 1,000 feet of lumber is a large one, and yet it would require 9,000 of such trees to furnish as much lumber as was consumed in building the flume. This number of trees, as can readily be seen, would make quite a forest.

In the course of the flume there are 315 trestles, the longest of which is 1,700 feet in length and eighty-five feet high. Its construction required 250,000 feet of lumber. This is the Los Cochos trestle. The Sweetwater trestle is 1,200 feet long and 85 feet high. The main timbers used in these trestles are 10 by 10 and 8 by 8. They were put together on the ground and raised to their position by horse power. There are eight tunnels in the course of the flume, the longest of which is 2,100 feet in length. The tunnels are 6 by 6 feet in size, with convex-shaped roofing. Each mile of the flume required, on an average, 250,000 feet of lumber for its construction, and the redwood used in the box is all two inches thick.

The San Diego flume is pronounced by men experienced in such enterprises to be the largest ever built in the world. So stupendous was the undertaking that at its conception many declared that it could not be built. Every obstacle has been now overcome, however, and the last spike in the flume driven. The water will be brought to the reservoir, about ten miles from San Diego, from which point it is proposed to pipe the water to the city. In regard to the mechanical work done in the construction of the flume, all who have examined it declare that it is first class in every particular. Engineers have fixed the grade every mile in order as near as possible to insure perfection in that important particular. The flume has a uniform grade of four and seven-tenths feet to the mile. An idea of the difficulties that have been overcome in the construction of the flume may be gained from a consideration of the fact that much of the lumber had to be drawn 700 and 800 feet up the sides of steep and rocky mountains. The lumber was loaded on cars that ran on a portable track. The cars were attached to a heavy wire cable. The motive power was furnished by a portable cable engine. The flume is now completed, and as the work of laying the pipes from the reservoir is comparatively an easy one, it will not be long before the water from the great flume will be flowing into our city.—*San Diego (Cal.) Sun.*

AN IMPROVED METHOD OF MOULDING.

A method by which two sets of patterns may be moulded in the sand facing each other, one portion of each set of patterns being arranged to form a gate or passage from one mould to the other, a single sprue being formed by means of a removable core in one section of the mould, is illustrated herewith, and has been patented by Mr. Edward Reddy, of Little Falls, N. Y.

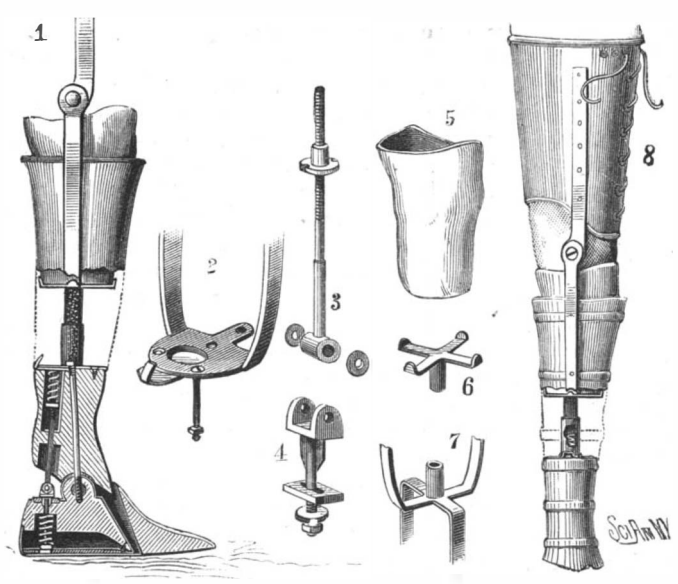


REDDY'S METHOD OF MOULDING.

The patterns are attached to removable plates adapted to be held in the flask as it is held open, while the two inner sections of the mould are formed. The two outer sections of the mould are then formed upon the backs of the plates, one being provided with a sprue core, when the plates are removed and the four sections are put together, making the mould complete. In this manner the bottom and top of each mould are formed of two separate and independent sections of sand, and both moulds may be filled through a single sprue.

AN IMPROVED ARTIFICIAL LEG.

An artificial limb designed for use by a person whose leg has been amputated between the knee and foot, and which will not chafe the stump of the wearer, is illustrated herewith, and forms the subject of two patents issued to Mr. Alexander Gault, of Medford, Minn. Figs. 1 and 8 show side elevations and a central vertical section through the ankle piece and foot, with parts broken away. Three sockets are employed, a thigh socket, a stump socket, and an outer socket for holding the stump socket, the outer socket being supported from the ankle or foot piece by brace rods. The stump socket is shown in Fig. 5, and is composed of hard vulcanized rubber or other suitable material possessing the desired rigidity. The thigh-socket supporting arms are supported from the stump-supporting arms shown in Fig. 2, being hinged thereto, and forming upward extensions of a base plate secured to the ankle piece by bolts which pass downward at each side at the back. The ankle bolt is of the ordinary form, but the joint is made of gutta percha or hard rubber. At the back of the ankle piece is a vertical bore in which works a rod, shown in Fig. 3, designed as a practical



GAULT'S ARTIFICIAL LEG.

substitute for the heel cord commonly employed, and also intended to obviate the necessity for a toe cord or an instep cord. That it may rock backward and forward, this heel rod is hinged at its lower end to the upper end of a bolt or guidepost of a heel spring, shown in Fig. 4, the bolt extending downward to a plane with the ball of the foot, while below the head of the bolt is a rubber or elastic block socketed in the upper face of the heel of the foot. With the movement of the body in walking, the ankle piece rocks on its joint, the coiled spring on the heel rod aiding the wearer in bending the knee and lending a natural movement to the same, while, by means of the sole plate and guide bolt, with the heel spring, the solid "wooden" sound, so noticeable with the ordinary artificial limb, is obviated.

Electricity as an Employment.

Recently, in the course of some remarks on this subject before the Young Men's Christian Association, in this city, Mr. Francis B. Crocker said: The question is asked, What kind of a man is required in this business? The answer is that it does not require a peculiar individual. A man need not let his hair grow long to make a good electrician. Any person of ordinary intelligence, without regard to race, color, or previous condition of servitude, is eligible.

As to whether it is best to go into the business or scientific branch of the industry, that depends entirely upon the man's taste and ability, and he can generally decide that point readily for himself. There is room at the desk as well as in the laboratory, drawing table, and work bench, and no one of these places is more important than the other, and the possibilities of success and a good salary are about equal in each case.

The preparation for entering this business is education and experience, and even these, though of course very desirable, are not absolutely necessary. It would generally be sufficient for a man going into the strictly business part of electricity to have had experience in some other branch of trade. In fact, a boy might go directly from an ordinary school into electrical business and have a very good chance of success; but if a young man has the time and money to spare, he will do very well to take a course in electrical engineering at some college, like Cornell or Stevens Institute, where particular attention is given to this subject, or at one of the scientific schools of Harvard, Yale, or Columbia. It is not necessary to go abroad to study, as more is actually done in one State on this side of the Atlantic than in the whole of Europe, including England. This education is more important to one going into the scientific part than to the prospective business man, but it would be time well spent in either case. Self-education is perfectly possible, and frequently produces the highest results. Edison himself is a distinguished example of this. I think persons generally stand too much in awe of the difficulty of understanding or even partially understanding this subject by their own exertions. A general idea of it is by no means difficult to obtain. Three or four days spent in studying an electrical book, or, still better, an electrical factory or station, will give one quite an inkling, and this improves and grows rapidly without much effort, if one is brought into daily contact with electrical things.

The next point to decide is what branch or application of electricity to select. This also depends somewhat upon the individual, but in most cases a young man would probably take the first good chance offered. But I think as a man can usually steer his own course more or less, it is well to know which way it is wise for him to try to go. It is considerably easier to go with the current than against it. In other words, there are some applications of electricity that are advantageous and easy of themselves, and some that are not, and if a man takes up one of the former class he is likely to be comparatively successful, whereas, if he takes up one of the latter classes, he will have uphill work, entirely irrespective of his own industry and intelligence. To take extreme examples, electricity will run these arc and incandescent lamps very satisfactorily, but so far it has not been found practicable or anywhere near practicable to run an ocean steamer by it. Any one taking up arc or incandescent electric lighting as a business will probably do well, but if any one was visionary enough to attempt making a business of building or operating electric ocean steamers, he would be very apt to die in the poorhouse or lunatic asylum. Of course it is possible that all this may be changed at any time by new discoveries, but all one can do is to judge by what is already known, and in the case of a beginner, it certainly is not wise to go beyond this. To carry this idea still further, one can judge of the likely directions of electrical progress, even before the advance occurs, and it is in one of these favorable directions that a man should try to go. The generation and distribution of electricity for light, power, and other useful purposes is a very good branch of the business to choose, because it is the fountain head, and all electrical progress will probably benefit it.

The propulsion of street cars by electricity is just now of particular importance, and this business is destined to be of great magnitude and one demanding the employment of hundreds of intelligent young men to run the central generating stations. The telegraph, which is the oldest and best established electrical business, is still a pretty good field. The telephone, which is financially the most successful of all, is a better field. Lighting is growing very rapidly, and will probably spread still faster in the future. Motor manufacturing and renting is one of the most promising branches.

THE NEW GAS HOLDER OF THE CONSOLIDATED GAS COMPANY, OF NEW YORK.

The largest gas holder in America is now rapidly approaching completion in this city. It is situated on Avenue C, occupying the block between Fifteenth and Sixteenth Streets. During the past summer the great framework has formed a conspicuous object for passengers on the steamers passing through the East River. When the sections of the holder proper rise between the uprights of the frame, the structure will appear still more impressive.

From the engineering standpoint, it is of special interest. The problem presented was the erection of a holder of the largest attainable capacity upon a piece of ground which not only was limited in area, but which was of the most unstable character at any great depth below the surface. To have made the usual excavation and to have built within it a brick tank would have been very expensive. The upper stratum of earth was what is called made ground, composed of dumpings from all parts of the city, underneath which quicksand was liable to be found at all places.

For these reasons it was decided to dispense with the sunken brick tank, and to build an iron one resting practically on the surface of the ground. To economize depth the holder is made in three sections, telescoping into each other. Thus the holder can rise above the tank curb to three times the height of the tank.

The ground where the tank stands was leveled off by excavation to a depth of about eight feet. One thousand twelve-inch piles forty feet long were driven over an annular area lying mostly within and corresponding to the general circumference of the tank. This left a circular area without piling in the center. Two feet of concrete were now laid, and on this the bottom plates of the tank were placed. The entire foundation is two hundred feet in diameter.

The tank is made of wrought iron. The plates at the lowest course are ⅞ inch thick, and are laid double, so as to give 1¾ inch thickness of metal. The plates are arranged to break joints. Where two plates abut, a strap of iron with six rows of rivets is carried over the joint. For each of these butt joints there is one strap, either inside or outside the tank, according to the locality of the joint. As the sides rise they diminish in thickness. The tank is 192 feet in diameter and 42 feet 9 inches deep.

Around the top of the tank a box girder is carried which forms the curb. Upon this the twenty-four standards used to guide the holder rest. These are made of iron channel bars and are tied together by lattice girders, of which several courses surround them. Between the girders diagonal bars extend, crossing in the center of the panel. At their crossing they are secured, so as not to strike against each other in stormy weather. At the top special trussing is used to resist any outward thrust that may be brought to bear upon the standards. The framework rises 125 feet above the curb, or about 150 feet above the street level.

The holder, as already stated, is in three sections, each about 41 feet high. At the upper curbs each section carries twenty-four roller brackets. The rollers work in guide rails carried up the uprights. The brackets are provided with both radial and tangential rollers. The first kind is identified with English and American practice; the tangential rollers are of French type. The combination of the two in the same bracket originated in England, and we believe is used in this holder for the first time in America. In the holder we are describing, the radial rollers are the larger and more securely fastened; the tangential rollers, comparatively small, are treated as subsidiaries.

The crown of the holder is stiffened circumferentially by a box girder. This is contained within the holder and is practically concealed. The outer circle of top plates and the upper circle of side plates form two of its sides; a horizontal circle of plates within the holder forms the lower element, and the open side is filled with lattice trusswork, so as to allow the gas free access. The crown is provided with internal radial trusses, extending to a central kingpost, which carries their inward ends when the holder is empty.

The general structure is based on recent English practice. The old style of columnar frame is departed from, and the securely braced uprights, with horizontal and diagonal bracing, recall the framework of the great Birmingham holders, illustrated in a former issue of this paper.*

The capacity of the holder is three million two hundred and fifty thousand cubic feet. Separate pipes are provided, one for inlet and one for outlet. They are thirty inches in diameter.

An impressive idea of its magnitude may be formed by ascending to the tank curb. The great crown lies on one side of the observer, and the East River is in clear view. As a schooner sails by with all sail set, the observer may recollect that there would probably be ample room to dock her, masts and all, within the gasometer when inflated.

Our illustrations give an excellent idea of the immense work, and also show the apparently risky work that has to be done in securing the diagonal members of the frame. It is gratifying to note that no life has yet been lost in the erection.

* See SCIENTIFIC AMERICAN, Sept. 4, 1886.

An Anaconda Killed in the Streets of New York.

It came out of the manhole of a sewer near the corner of First Street and Second Avenue on Wednesday afternoon, October 3, just as school was letting out at grammar school No. 79, on First Street, a few doors away, and hundreds of children were pouring out. When first seen it was gliding along First Street toward First Avenue. The children saw it and shrieked.

"Look out for the crocodile!" screamed one of them as they ran. Their cries brought hundreds more of persons flocking from doors all along the block, and heads appeared at every window. The school janitors and other grown persons hustled the children back into the building and up the high stoops in the neighborhood. As the snake moved along, men, women, and children fled before it, screaming warnings to others ahead.

At first the snake took its time about covering ground, but in a minute or two the throng pressing closer behind it apparently annoyed or terrified it. It stopped and threw itself into a coil, with three or four feet of very vicious-looking body vibrating upright from the center and a mouth eight inches long gaping open to let a forked tongue spit out. The children screamed louder than ever, and everybody that could run did so.

It was at this moment that Mr. Burckhardt first saw the snake that he had coiled up in his market basket the day before. The noise in the street had called him to his window, and just as he had taken one look at it the creature sprang forward. Mr. Burckhardt's hair still rises perceptibly as he tells of it.

"I could just see it as it flashed by," he said. "Four men had run out from the wheelwright's shop with whatever they could lay hands on for a club. The snake stopped again, seeing the crowd, and made itself into a coil ready to spring. One of the men jumped forward and hit it a terrible blow on the back of the neck. It dropped to the pavement, and before it could get up again the rest of the men, and everybody else that could get anything for a club, were on top of it, hammering the life out of it. It fought desperately, but it had no chance."

The snake is undoubtedly a genuine anaconda, nearly full grown. Its body measures easily a foot in circumference at its thickest part, and its length of nine feet six inches was verified by Mr. Burckhardt, who stretched it out on his floor and measured it. It is so cut and bruised from the beating it had with clubs that it is doubtful if its skin can be preserved. It is supposed that it came from some South American vessel unloading at an East River dock, crept into the sewers and along them to the place where it reached the street. Some sailor probably brought it from South America. It may have come from there when young, hidden in fruit or other cargo, and have grown to its present size in the sewers, but that is not likely. —*N. Y. Sun.*

Electric Light in Night Firing.

The *Weser Zeitung* gives an account of an interesting series of trials recently made in Germany for testing the value of the electric light in night firing. The targets were placed at a range of 400 meters from the riflemen, while the electric light generator was situated 200 meters behind the firing party. The apparatus consisted of a steam engine, an electric dynamo mounted on a carriage, and a projector. The steam engine registered 18 horse power. The light was obtained from an incandescent lamp, which may be placed at a distance of 200 meters from the dynamo. The intensity of the cone of light produced by the arc is so great that pencil writing can be read at 4,000 meters. The result of the experiments was that nine shots out of ten struck the targets. The apparatus can only be placed *hors de combat* if a shot should strike and break one of the carbon supports, but this is an extremely improbable contingency. The illuminating wagon, as it is called, has been attached to the Prussian engineers, and will be used in the attack and defense of fortresses. Its weight is too considerable to admit of its being extensively used in the field.

Effect of Flour Mill Dust.

In order to test the effect of constant inhalation of dust in flour mills on the animal organism, M. L. Poincarre kept guinea pigs for two years in the most dusty part of a flour mill—that is to say, the department where the corn is cleansed from all extraneous matter by a special machine before being ground. Of twenty animals, ten remained alive at the end of two years. Those that died were mostly young ones. None of these showed traces of tuberculosis, but catarrhal pneumonia with profuse desquamation of epithelium; also in some cases localized interstitial pneumonia and extravasation of blood. Dust, consisting of grains of starch, etc., was found, more particularly on the nasal mucous membrane, but only to a small extent in the bronchi.—*Lancet.*

Correspondence.

Beating the Weighing Machine.

To the Editor of the Scientific American:

The SCIENTIFIC AMERICAN of October 13 contains an article, "Beating the Weighing Machine." The writer has witnessed a worse beat than the one mentioned. One of these machines is stationed at a certain railroad station in this State. The same room contains a newsstand, attended by a boy who will tie a string to a nickel, step on the platform, drop the nickel in the machine, and get his weight. Before stepping off, he calls up next, the machine giving their combined weight. The boy steps off, at which the machine gives the correct weight of No. 2. This process is repeated until the supply of subjects to be weighed is exhausted. Now, before the last party steps down, the boy, who has held on to the string all this time, carefully pulls in the string and gets his nickel back. I am of the opinion, when this machine is examined for cash, there will be little found. "S. M."

Indianapolis, Oct. 13, 1888.

Black Snake with a White Ring.

To the Editor of the Scientific American:

In your issue of October 6 last I noticed an article on "Habits of the Black Snake," taken from the *Forest and Stream.* With your kind permission, I would like to make an exception to the above article.

The writer, in referring to the black snake with a "white ring" around its neck, writes with considerable emphasis as to the "white ring" being "all imagination," and claims that "natural history does not mention the species."

The latter assertion I am not sufficiently informed upon to write with any degree of certainty. As to the "white ring," however, I have in my possession a small snake as black as the "ace of spades" with a perfect white circle around its neck.

I have killed several of the same species within the past five years.

They are quite rare, however, and out of three or four hundred snakes that I have dispatched within that period, of all descriptions, from the harmless garter to the deadly copperhead, I find, upon careful comparison of habits and form, that differ only in length, the "white ring" measuring from 16 inches to 2 feet 6 inches, while those without the rings vary from 1 to 7 feet. The scarcity of the former, however, may account for the absence of the large ones.

I have not the slightest doubt, however, there are "white rings" as large as their "solid colored" friends, and if not classified, must be closely related.

At all events, there is such a reptile as a black colored snake with a "white ring" around its neck, and black and white are the only colors found upon the snake in question. An old stone fence or rubbish heap seems to be the favorite abode of the "white ring." Sometimes it is captured on a dry, dusty highway, sunning itself, or twisted around some stunted oak or maple in search of birds, field mice, and toads.

As to being chased, I cannot speak from experience, as I never have been in the humor to run. I prefer fighting every time. I know of timid people, however, whose word could not be doubted upon ordinary occasions, who speak with great positiveness as to running away and having a big snake chase them.

In the warm spring days, when the black snake is mating, I have noticed him to be more aggressive than at any other time, and would show fight in preference to running away. W. S. POST.

Saugerties, N. Y., Oct. 8, 1888.

Brick the Best Building Material.

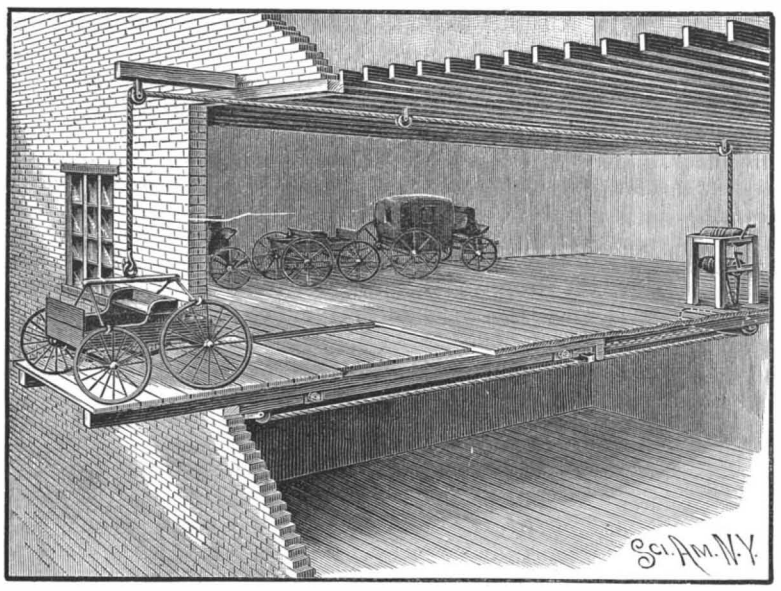
Insurance men, as a general rule, claim that a building which is largely constructed of iron is not necessarily fireproof. This may be true to a great extent, says the *American Builder.* Iron, when heated, bends very readily under weight, and therefore of itself cannot be called fireproof. There is much, however, to be said in favor of iron construction. It prevents fire from spreading, and unless there is a large amount of inflamable material within reach of the flames, there is little danger that fire will make very much headway.

Stone and granite are very little better than iron to withstand the ravages of fire. There is no material that can be used for construction equal to brick. Every brick bears its own weight. Bricks have already passed the fiery ordeal before they are used in buildings, and are tempered. Cast iron is not substantial enough, and wrought iron, which is an improvement, stands fire but little better. For a fireproof building we would construct one of fire brick. Then glaze them and give them a good appearance, which is rather ornamental than otherwise.

There are, however, many kinds of material made for the purpose of fireproofing a building after it is constructed, but we are only speaking here of material which is used in construction, and we have the opinions of both insurance men and heads of fire departments, who vie with each other that brick has stood the test better than any other material.

AN ELEVATOR FOR HOISTING CARRIAGES.

A mechanism for hoisting vehicles, etc., outside of buildings, to land them upon an upper floor with facility, while saving the space that would be required within the building for a hatch or inclined way, is illustrated herewith and has been patented by Mr. George L. Loomis, of Northampton, Mass. A platform having a surface large enough to hold a carriage is adapted to be projected between the jambs of a door and beyond the wall of a building on the second or a higher floor, the platform being secured upon a frame consisting of two beams extending from the outer end of the platform inward between the joists. These beams have their inner ends united by a cross piece extending beneath two or more joists, and rest upon friction rolls journaled in the joists, whereby the beams can be moved over the door sill, or in grooves cut in it, to move the platform out and in. In a line centrally with the frame, and to the rear thereof, is a windlass frame in which is journaled two drums, a cord from the lower drum passing over a pulley secured beneath the door sill, and being made fast to the frame, whereby the latter may be moved in and out, as the drum is rotated in one direction or the other by means of its crank-handle. From the upper drum on the windlass frame, which is provided with the usual pawl and ratchet and crank handle, a cord passes through a hoisting block upon a beam projecting from the building, the outer end of the cord being provided with a sling upon which the vehicle to be raised or lowered can be readily secured. The platform when retracted is adapted to pass over the floor proper, leaving, when extended, a surface over which things may be easily and safely moved.



LOOMIS' CARRIAGE ELEVATOR.

THE BUTTING VIPER.

Although Africa contains no Crotalus nor Bothrops nor Trigonocephalus, she is, in return, the country of vipers, for, with the exception of a few species that inhabit Europe and Asia, all the rest are peculiar to that country. The butting viper (*Vipera arietans*), which forms the subject of this article, is found throughout entire Africa, with the exception of the Mediterranean region, and is met with especially along the coasts of the southwest as far as to the Cape. Two huge specimens of this species have just reached the reptile menagerie of the Paris Museum from Senegal. The body of this serpent, which is short, thick, and squat, rarely exceeds four feet in total length. It tapers considerably in the cervical region and terminates in front in a triangular head with rounded angles, somewhat cordiform, much wider than the neck, and very much depressed. The tail is conical and very short. Its thickset form gives the animal a hideous aspect. The nostrils, which are widely open, and their circumference destitute of scales, are very close to each other, and situated directly above the snout, and not at the sides, as in other species of the same genus. This is what led the German naturalist Merrem to group the vipers that present this peculiarity under the generic name of *Echidna*, reserving that of *Vipera* for those in which the nostrils open laterally. Behind, and externally to the nostrils, are the eyes, which are set very close on account of the shortness of the snout.

As in all vipers, the upper jaw is provided on each side and in front with a series of from three to five highly developed, channeled, venomous fangs, which are of unequal size, movable, conical, and bent backward, and which straighten up when the animal opens its mouth. The duct that they contain gives passage to the poison, and opens upon their front edge, near the extremity, in an elongated slit. These fangs are very sharp, and their conical shape permits them to enter tissues in such a way as to gradually separate them without tearing them. When the fang is withdrawn from the wound—a simple puncture—the skin, by virtue of its elasticity, resumes its place and imprisons the inoculated venom, which is almost instantaneously carried by the circulation throughout the entire organism. The entire top of the body, including the head, is covered with carinate scales arranged with great regularity.

The coloration of this viper is very variable. In the museum specimens the dominant color is a light and somewhat tawny brown. This, upon the back, is relieved by a series of darker stripes, open in front, and, for the most part, exhibiting a yellowish border behind. At the lower part of the sides there is likewise a longitudinal row of dark spots, and the top of the head is, at the level of the eyes, traversed by a brown band, which descends on each side to the edge of the upper lip.

Indolent and sluggish to the highest degree, the butting viper usually remains entirely immovable, its body coiled, and the head resting upon one of the coils. The lower figure in the engraving represents it in this state of repose. Its repugnance to motion is such that it allows itself to be approached almost to contact without stirring. It scarcely moves, except to seek food, or to make an attack, or to escape. Then it makes rapid motions, which form a marked contrast with its natural slowness. If it is disturbed, it at once puts itself on guard by drawing back its head, and twisting its neck into the shape of the letter S, ready to untwist it and straighten it like a spring, so as to throw the head forward in order to bite. At the same time, its body is seen to inflate and alternately return upon itself, thus showing its irritation. Sometimes, too, it hisses long and loudly. It has the singular habit (whence is derived its name) of beginning an attack by butting with its head like a ram.

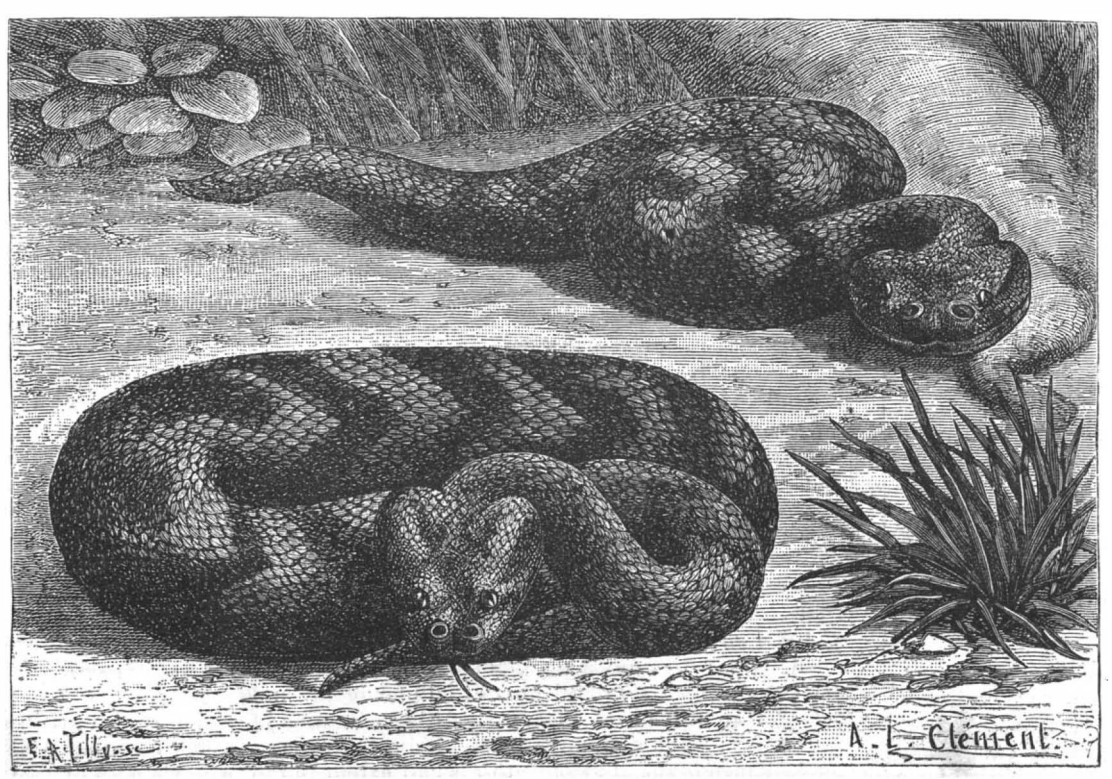
In a state of liberty, small mammals, such as rats, mice, and squirrels, form the habitual food of the butting viper, but it catches birds also. In captivity, it is fed upon rats, and sometimes upon young rabbits, and the very variable intervals that separate two meals is, on an average, twenty-five days.

Exclusively of the slowness with which it decides to attack its victims, its mode of doing so is the same as that of other vipers. Put in the presence of an animal which it is about to make its prey, it immediately twists its neck, as has been described, ready for the attack. Its respiration quickens and becomes deeper, while at the same time it darts out its forked tongue, and at times strikes the animal with its head. Its anger keeps increasing until finally it springs with the quickness of a flash upon its prey, which it pierces with its long, venomous fangs, and which in most cases utters a cry of distress. Then it springs back with the same abruptness and waits, motionless, until the venom has accomplished its work of death. The victim, which at first seems filled with astonishment, soon falls upon its side, as if paralyzed, and, after a few convulsive motions, expires in the space of one or two minutes. The viper then returns to it with a slow, gliding motion, noses the entire body, and finally seizes the latter by the head and swallows it.

From the manner in which these animals attack their victims, one would be tempted to believe that they are conscious of the terrible effects that the inoculation of their venom immediately produces. But such is not the case, for they behave in the same manner when recently killed animals are offered to them, and boas, too, coil around such animals, in order to strangle them, just as if they were living. These acts, which seem due to reason, are instinctive.

The venom of the butting viper cedes in no respect to that of the rattlesnake. Dogs of large size rapidly succumb after being bitten, and cases are cited in which man has been unable to resist its action. It is even asserted that the Hottentots, whose country is infested with these reptiles, use the venom to poison their arrows by mixing it with the juice of certain plants.

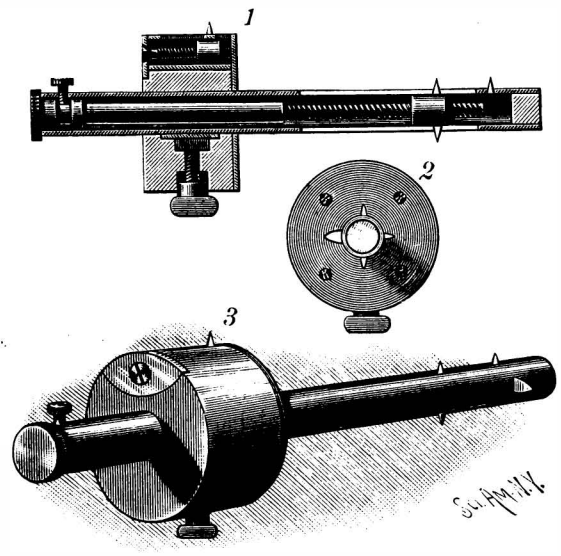
The reptile endures captivity well, provided that the temperature of its cage is sufficiently high. It feeds with considerable regularity, and is easily preserved for several years.—*La Nature.*



THE BUTTING VIPER.

AN IMPROVED GAUGE FOR WOODWORKERS.

A gauge which can be readily adjusted for mortising, cutting, or marking, two or three different widths, or marking one or two widths and cutting another, or for marking a width from the shoulder of a rabbeted or otherwise checked piece of wood at will, is illustrated herewith, and has been patented by Mr. Wm. B. Little, of New York City. On its tubular stock is mounted to slide an adjustable cylindrical fence with a set screw for clamping it in the usual way, and near the outer end of the stock, on one side, is fixed a projecting marking point, a cutting point being fixed somewhat nearer the outer end on the opposite side. On the outside of the stock, angularly midway between these points, is fixed a mortise-marking point, inside of which is a longitudinally adjustable mortise-marking point, riding in a slot in the stock, and projecting from a cylindrical nut sliding within the stock, as shown in the sectional view, Fig. 1. The nut is threaded to work on an internal threaded spindle, the outer end of which has a milled head projecting out of the stock. The stock also carries another directly opposite longitudinal slot, in which rides another marking point also carried by the nut, and adjustable therewith. The fence is closed at its outer end by a metallic face plate, shown in Fig. 2, and at its inner end by a detachable metallic bearing plate, mortised in and attached to the back of the fence, as shown in Fig. 3, and in one side of the fence is a longitudinal tubular guide, in which slides a cylindrical nut carrying a marking point which projects through a slot on the outside



LITTLE'S COMBINATION GAUGE.

of the guide. This point can be readily adjusted to any desired distance from the front of the fence, for use, as usual, in marking a line inside of a checked piece of wood.

For further information in relation to this invention address the inventor, in care of Mr. Thomas Young, of No. 5 Greenwich Avenue, New York City.

Electrical Production of Diamonds.

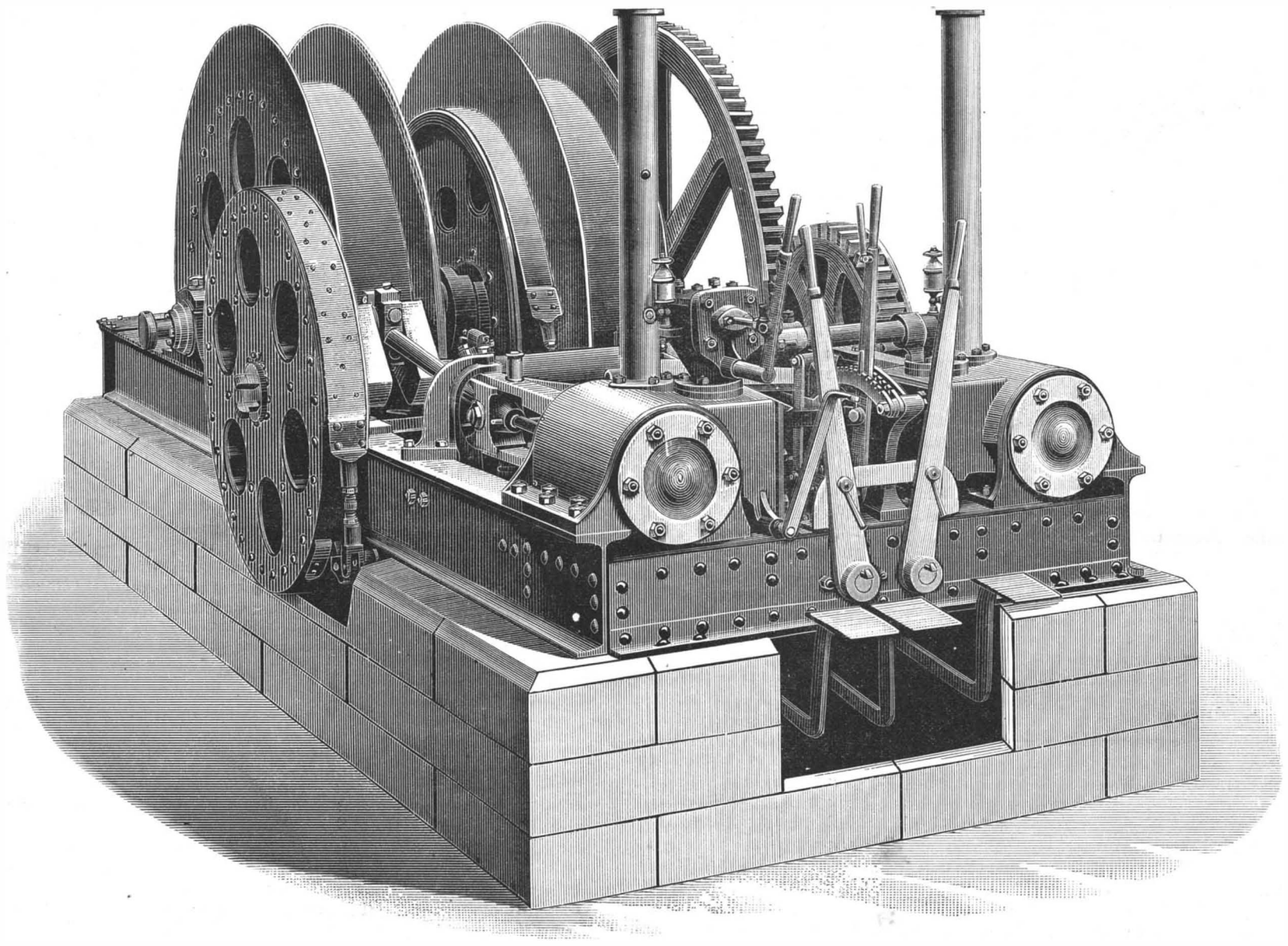
The Hon. C. A. Parsons describes in an interesting communication to the Royal Society, which is published in abstract in *Engineering*, a number of experiments which he has recently made on carbon at high temperatures and under great pressures, and in contact with other substances. The primary object of the experiments was to obtain a dense form of carbon for use in arc and incandescent lamps, for, as it is well known, could the life of the carbons of either variety of lamp be prolonged, a considerable economy could be effected in electric lighting.

Looking at the experiments from this point of view, it may be stated that the experiments were not entirely successful, though a very dense form of carbon was in one case obtained, but nevertheless some results are of very great interest, as, though the author expresses himself very cautiously, it would appear that he has succeeded in producing diamond dust artificially. The arrangement of the experiment was as follows: A massive cylindrical steel mould, of about 3 inches internal diameter and 6 inches high, was placed under a hydraulic press; the bottom of the mould being closed by a spigot and asbestos rubber packing—similar to the gas check in guns. The top was closed by a plunger similarly packed; this packing was perfectly tight at all pressures. In the spigot was a vertically bored hole, into which the bottom end of the carbon rod to be treated fitted. The top end of the carbon rod was connected electrically to the mould by a copper cap, which also helped to support the carbon rod in a central position. The block and spigot were insulated electrically from the mould by asbestos; and the leading wires from the dynamo being connected to the block and mould respectively, the current passed along the carbon rod in the interior of the mould. The free space in the mould was filled in turn with different hydrocarbons and with other materials.

Among the liquids acted on were benzine, paraffine, treacle, chloride and bisulphide of carbon, and the solids included silica, alumina, carbonate and oxide of magnesia and alumina. The pressure employed ranged from five to thirty tons per square inch. In the experiment with silica the density of the carbon was increased 30 per cent, and in no other case. The most interesting set of experiments was when the mould around the rod was filled with a layer of slaked lime about one-fourth inch thick, surmounted by two inches of silver sand, followed by a layer of lime of the same thickness, and finally by a layer of coke dust. The pressures used ranged from five to thirty tons, and the current from two hundred to three hundred amperes, the carbon being in different experiments from one-fourth inch to five-sixteenths inch in diameter. Under these conditions there was obtained on the surface of the carbon rod a powder of a gray color, harder than emery, and capable of scratching the diamond. This powder is, therefore, very probably the diamond itself.

SIXTEEN HORSE POWER WINDING ENGINE.

We illustrate a winding engine exhibited at the recent Nottingham show. This engine is fitted with two large winding drums, each connected to its own shaft by independent clutches, so that either drum can be used quite independently of the others. The frame is made of steel or wrought iron girders, the engine being specially designed for use in countries where skilled labor not being available, repairs are troublesome and costly; in fact, cast iron is nowhere used except in the cylinders and one or two minor brackets. Each drum is fitted with a brake, and there is also one on the flywheel, so that complete control is secured under all circumstances. The cylinders are 9 inches in diameter with 16 inches stroke, and the engine is fitted to carry a working pressure of 100 pounds. The *Engineer*, to which we are indebted for our illustration, says a large number of similar engines is in use in the mining districts of the various colonies. They are thoroughly well made, and calculated to stand a great deal of hard work.



SIXTEEN HORSE POWER WINDING ENGINE.

Trial of a New Torpedo.

The Naval Board of Ordnance, at College Point, N. Y., have been testing recently a torpedo which is the invention of two Americans, Messrs. Geo. E. Haight and Wm. H. Wood, the former of whom is now in France instructing the naval officers of that country in the use of the invention, the French government having bought one for trial.

The board consists of: Capt. A. P. Cook, president; Capt. C F. Goodrich, Lieut.-Comdr. R. B. Bradford, Lieut. A. R. Couden, and Lieut. S. P. Comley.

The torpedo is cigar shape and is united to a float of the same shape, which lies three feet above it, by four knife-edged stanchions. The torpedo projects beyond the float at the bow, and at its stem is a propeller, above which is the rudder. From the stern there trails an electric wire, which connects with a keyboard on shore, or wherever the torpedo station is. Fore and aft on the upper vessel or hull, which is the only one which is seen at all above the water, are two flags, which serve as sights by which to guide it. The upper cigar is 18 inches in diameter and 44 feet long. The lower one is 24 inches in diameter and 40 feet in length, this latter being charged in the head with about 300 to 400 pounds of high explosive, which is fired either by the percussion of the cylinder against the side of the vessel or by an electric current from the shore, as desired.

The lower hull also contains the engines, which are of the 6-cylinder type, and the supply of compressed carbonic acid gas with which they run; also a device by which the gas is heated. The heating of the gas is accomplished by coils of copper pipes incased in cylinders containing sulphuric acid and having lime chambers at each end. The sulphuric acid and the lime may be brought in contact by electricity when desired, and will, in less than a minute, heat the gas up to 600° F., and keep it hot from one to three hours. The engines, each of which takes up only fifteen by twenty-four inches of space, can run 800 turns per minute, at which speed each will develop 75 horse power, the speed of the torpedo being 20 to 24 miles an hour, which speed can be maintained for a run of one to one and a half miles with one charging of gas.

The torpedo is expected to cut through rope netting of inch hemp rope and strike the target fair and square, exploding at once. The entire torpedo, with its propelling and steering machinery and its charge of dynamite, nitro-glycerine, or whatever other explosive is chosen, weighs 2¼ tons, the engine weighing 524 pounds.

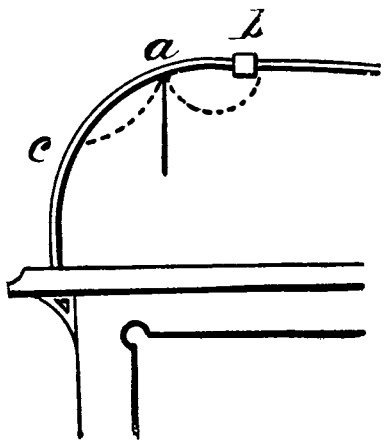
For the experiments before the board, the navy yard tug Nina anchored behind a net target 130 feet long, three-quarters of a mile from shore, representing a man-of-war, defended by her torpedo nettings, the explosive charge consisting of a can of powder on top of the forward flag of the torpedo, but fired by the regular cap head of the submarine weapon.

The distance, three-quarters of a mile, was covered in 2 minutes 52 seconds, official time, or at the rate of say 18 miles an hour. Subsequent examination showed that the torpedo cut clean through the netting, broke her forward stanchion in so doing, and then headed away in a go-as-she-pleased trip. The torpedo also snapped her connecting wire.—*Army and Navy Jour.*

M. CHEVREUL has entered his 103d year. The other day he walked through the Sanitary Exhibition, at the Palace of Industry, Paris.

AN INTERESTING ELECTRICAL EXPERIMENT.

There is a very pretty electrical experiment which always excites considerable curiosity and interest, that, so far as known, has never been described in print. One end of a piece of soft cotton string, about four inches long, is pasted, by means of a small bit of paper, to the inside of the cylindrical glass front of a show case, in about the position shown at *a* in the engraving, in such a manner that the string hangs freely down. The outer surface of the glass, from *a* to *c*, is then briskly rubbed from side to side with the back of the hand or with a dry silk handkerchief. The glass is thus electrified, and the string also takes a charge either by induction or leakage, and is repelled by the rubbed glass. At each movement of the hand the string sways from side to side, and finally, when the glass is sufficiently excited, it curls up so as to touch the unelectrified part of the show case, at *b*, as shown by the dotted line. If the finger is now held for a few moments against the glass at *a*, the string is discharged, and is forthwith attracted up to the front of the case in the position shown by the dotted line at *c*. Pressing the finger against the glass at *c* discharges it there, and the string quickly jumps away and clings to some place that is still electrified. This action may sometimes be repeated five or six times before the glass is wholly discharged, the string being made to fly to and fro until one is tempted to believe it endowed with life.



As in all experiments in frictional electricity, dryness is essential to success, and if one's hands are at all moist the experiment fails. In summer it is almost impossible to make the string do more than sway slightly when the glass is rubbed; but on a dry winter day it is as lively as a grasshopper. A. B. P.

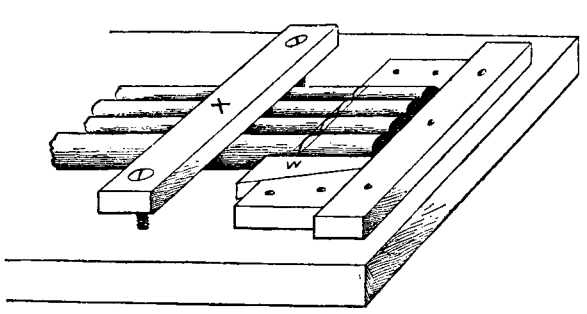
INEXPENSIVE CARBON PLATES FOR GRENET BATTERIES, ETC.

BY CHAS. FETZES.

The following is the method adopted by the writer for the utilization of cast-off electric light carbons in making plates for a small motor battery:

At almost any electric light station which uses arc lights may be obtained numbers of rejected carbons, which are unfit for use in the lamps, owing to some defect in the manufacture. These defects, however, do not injure them in any way for use in the battery. These carbons can be had for the asking, or for a moderate sum.

The ordinary carbon is long enough to allow of being cut into two pieces about six inches long, but plates of the whole length and as wide as desired may be made. For simplicity's sake, a plate $6 \times 1\frac{3}{4}$ inches is represented in the sketch, which also represents the manner in which the carbon rods are pressed together and held flat while being soldered, the first office being performed by the wedge, W, the latter by the strip of wood, X; the whole arrangement being made of wood, except nails and screws. To prepare the carbon rods, the copper coating is removed by nitric acid, taking care to leave about one or one and a half inches of copper on one end of each rod. When taken from the acid they should be washed and dried, then placed in the "holder," as shown in the sketch, having all the coppered ends together. Apply soldering acid in the grooves between the coppered ends, and with a soldering copper, heated just enough to melt common solder, rub the solder in until it "takes," which will be in a moment.



When one side has had all the grooves filled, turn the plate over and repeat the process on the other side. Before using the plate in the battery, it should be coated with paraffine for about one-half inch below the copper, and the paraffine should be worked into the grooves, otherwise the acids from the battery would be drawn up by capillary attraction and soon destroy the copper and cause the rods to fall apart. The writer has made these plates and used them in a battery for driving a small motor, and can say that they are equal to any of the plates manufactured by the trade for battery purposes—in some cases superior—as the carbon rods are very compact and of fine texture.

It is best when applying the paraffine to warm the plate, have the paraffine melted, and apply with a small brush.

Tractive Power of Locomotives.

Mr. M. N. Forney thus explains the meaning of the term tractive power of a locomotive. It is the force with which the locomotive is urged in a horizontal direction by the pressure of the steam in the cylinders, and which therefore tends to move the locomotive and draw the load attached to it. The tractive power is due to the pressure of steam on the pistons, and therefore its amount is dependent upon the average steam pressure in the cylinders on the area of the piston and also on the distance through which the pressure is exerted—or, in other words, on the stroke of the piston. Thus, if we have a cylinder 17 inches in diameter and 2 feet stroke, and an average steam pressure of 50 pounds per square inch, then, as the area of such a piston would be 227 square inches, the average pressure on it would be $227 \times 50 = 11{,}350$ pounds, and, as each piston moves through 4 feet during one revolution of the wheels, the number of foot pounds of energy exerted by it would be $11{,}350 \times 4 = 45{,}400$, and for the two cylinders of a locomotive double that amount, or 90,800 foot pounds. If the driving wheels are 5 feet in diameter, their circumference will be 15·7 feet, and therefore the locomotive will move that distance on the rails during one revolution, if the wheels do not slip. The 90,800 foot pounds of energy is therefore exerted through a distance of 15·7 feet, and therefore

$$\frac{90{,}800}{15{\cdot}7} = 5{,}783 \text{ pounds},$$

which is the force exerted through each foot that the circumference of the wheel revolves and the locomotive moves. If the wheels were only half the diameter, or 2½ feet, then their circumference would be 7·85 feet, and the tractive power would be

$$\frac{90{,}800}{7{\cdot}85} = 11{,}566 \text{ pounds},$$

or double what it was before. It will be seen, then, that the tractive force of a locomotive is dependent upon: 1. The average steam pressure in the cylinders. 2. The area of the pistons. 3. The stroke of the pistons. And, 4. The diameter of the driving wheels. The tractive power of a locomotive is, therefore, found by multiplying together the area of the piston in square inches, the average steam pressure in pounds per square inch on the piston during the whole stroke and four times the length of the stroke of the piston, and dividing the product by the circumference of the wheels. The result will be the tractive power exerted in pounds. The adhesion must, of course, always exceed the tractive force, otherwise the wheels will slip.

Our Population in 1890.

The census of 1890, preparations for which are already being made, promises to show in the United States a population of more than 70,000,000. The population in 1880, according to the census of that year, was 50,155,783 persons, of whom 43,475,840 were native and 6,679,943 foreign born. The natives had increased 10,484,698 from the figures of 1870--32,991,142—or 31·5 per cent. The foreign element had gained more slowly, however, bringing the percentage for the entire population down to 30 per cent. The same rate of increase applied to the census of 1880 will, according to the Philadelphia *Record*, give an increase of 15,046,639 persons during ten years ending in 1890.

The immigration between 1870 and 1880 was comparatively light, only 1,112,714 persons having come to this country during that decade. For the past few years, however, it has been unprecedented. The immigration since the last census has been as follows:

1880	457,257
1881	669,431
1882	788,992
1883	603,322
1884	518,592
1885	395,346
1886	334,203
1887	490,109
1888 (8 months)	380,000
	4,637,252
Estimate for 2 years and 4 months	1,100,000
Total for 10 years	5,737,252

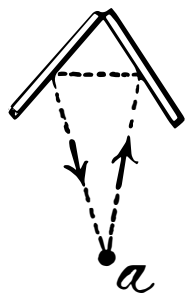
Add this total to the increase in the native-born population at the rate which prevailed from 1870 to 1880, and it will be found that the probable increase in population during the present decade, after making due allowances for births and deaths, will have been 20,246,639, and the total population in 1890, native and foreign born, 70,322,479, divided as follows:

Native	32,991,142	43,475,840	58,522,479
Foreign born	5,567,229	6,679,943	11,800,000
Total	38,558,371	50,155,783	70,322,479

It is very evident that the foreign element will form a much larger proportion of the population in 1890 than ever before. In 1860 this proportion was about 13 per cent, in 1870 14 per cent, and in 1880 about 15 per cent. In 1890 it will not be far from 18 per cent.

EXPERIMENT WITH MIRRORS.

Every one knows that in images produced by a mirror there is lateral inversion; that is, right and left are reversed. We have become so accustomed to this inversion that we rarely notice it unless a printed page is held before the mirror, when the fact that the words appear "backward" recalls it to us. If we arrange two mirrors so that there is a double reflection, the inversion is got rid of, and some curious effects are obtained. Put two mirrors edge to edge, at an angle somewhat less than 90 degrees, and hold a book in front of them in the position *a* in the sketch. An image of the book is seen in each mirror, but because of the two reflections, indicated by the dotted lines, there is no inversion; a fact which we recognize by the words appearing in their natural order. Now stand at *a*, and, fixing the attention on one of the images of the face in the mirrors, attempt to brush the hair. The result is ludicrous. The brush is almost surely put to the wrong side of the head and the hair brushed the wrong way, and it is usually some little time before one sufficiently becomes accustomed to the odd effect to use the brush with confidence.



A. B. P.

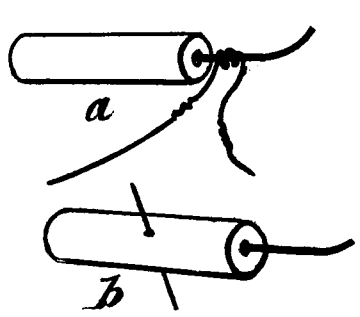
Pottery in Limoges.

China is selling at a lower rate now, says Consul Guffin, of Limoges, than it has done for many years past, the reason being that the price of labor has decreased 10 per cent in the last five years, machinery has in many instances replaced hand labor, and the saucer maker has entirely disappeared since the strike in 1883. The rates of interest and insurance greatly favor the manufacturer. The price of coal and wood is lower than in previous years, the former costing from 25 francs to 35 francs per ton delivered at the factory, and the price of the latter is from 10 francs to 12 francs per stere. The year 1887 shows a decided decrease in the production of china; there was a steady decline from 1882 to 1886. In the year 1887 there was employed in the manufacture of china at Limoges 1;621 coal furnaces, as compared with 1,528 in the preceding year, and 324 wood furnaces, against 323 in 1886. Some manufacturers burn wood, although it is more expensive than coal, the reason of this being that they think the sulphurous fumes from the coal injure the color of the china. Few colors have yet been discovered that will resist the gases of coal, so wood is used exclusively to heat the *moufles*, the furnace where the paintings are fired. Limoges china is in demand all over the world, but by far the largest share goes to the United States. The production last year amounted to over $1,600,000, nearly half of which was exported to the United States.

EXPERIMENTAL ELECTRIC FUSE.

Nothing interests a class in electricity more than a homely illustration of some industrial application of the science. An experiment, if it be a good one, is all the more effective when performed without the aid of elaborate apparatus from the instrument maker, and if it be one which the student can repeat at home, he is the better pleased.

One of the minor applications of electricity with which every one is familiar, but which is rarely illustrated in the class room, is that of firing blasts at a distance by means of an electric fuse. Young people will enjoy the following illustration. Wrap a short piece of very thin iron or platinum wire about the fuse of a fire cracker, as shown in the figure at *a*. Stout copper wires are attached to the ends of the thin wire, and led through the window on the sill of which the cracker is placed. On connecting the copper terminals to the poles of a battery, the thin wire is heated to incandescence, the fuse is lighted, and in a moment the cracker explodes. If it is desired to make the blast instantaneous, a pinhole is made through the middle of the cracker, and the thin wire is threaded through it so as to be in immediate contact with the powder. When a sufficiently thin wire is used, a single Grenet or Bunsen cell is enough to fire the fuse. For economy's sake it is better to use iron than platinum wire in these experiments. Very thin iron wire can be bought on spools, and it may be easily made still thinner, if necessary, by immersing it for a few moments in dilute sulphuric or nitric acid. A. B. P.



AN IMPROVED CALCULATING MACHINE.

There has lately been invented by Mr. Dorr E. Felt, of Chicago, a calculating machine which he has named the comptometer. It is a practical machine operated by keys for the computation of numbers and the solution of mathematical problems. The rapidity and accuracy with which computations are made on the comptometer when in the hands of a skillful operator are calculated to meet the approval and win the admiration of all.

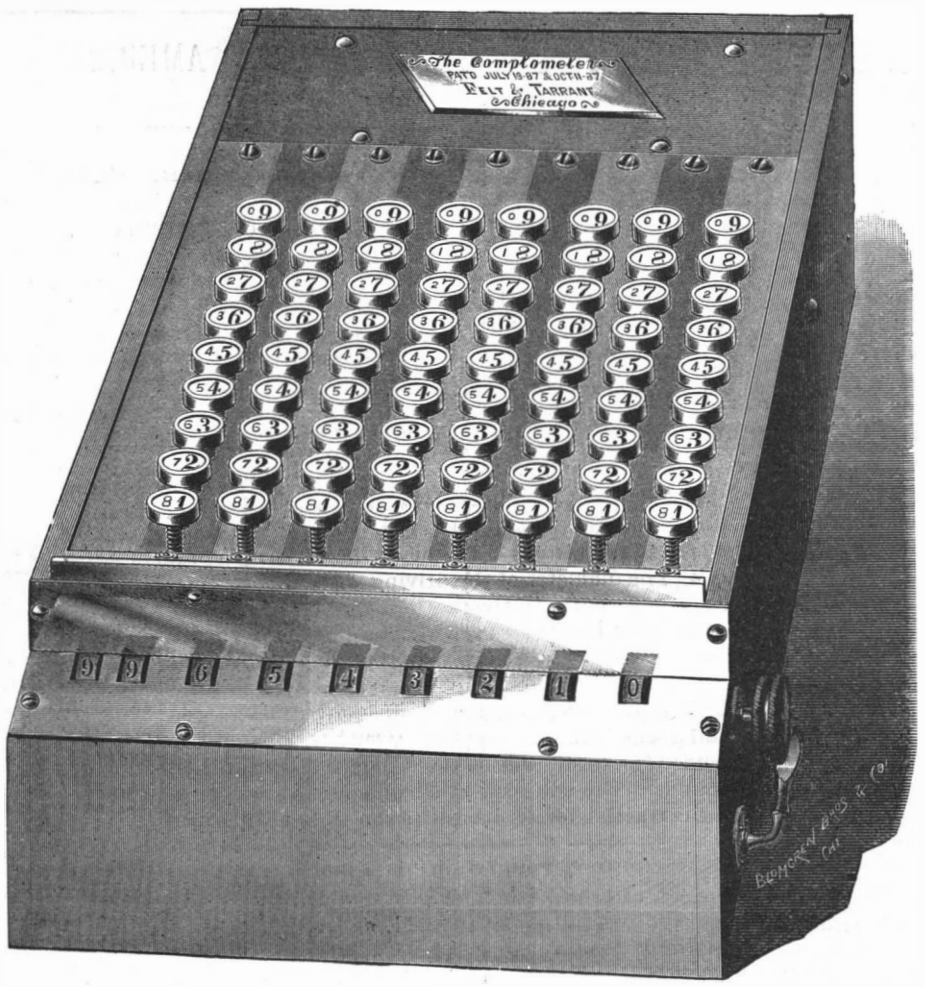
In the construction of the comptometer all the operating parts are made of the finest hardened steel, thus insuring the greatest degree of durability. The accuracy and durability of the machine have been thoroughly tested in the actuary's department of the United States Treasury at Washington, where one is in constant use. It will add, subtract, multiply, and divide, from which it is evident that all arithmetical problems can be solved on it. Particular attention is called to its availability in computing interest, discount, percentage, and exchange. It is a neat, compact machine, fourteen and one-quarter inches long, seven and one-quarter inches wide, and five inches high, weighing eight and a half pounds.

By referring to the cut, it will be seen that each key has two numbers on its top, one large and the other small, but for the present leave the small one out of consideration, and understand every reference to be to the large one only. It will be seen that the keys resolve themselves into rows running from right to left and rows running from the operator. For convenience in explaining, the rows running from right to left will be called rows, and those running from the operator will be called series. It will be further noticed that every key in the first row has the figure 1 on its top, those in the second the figure 2, those in the third the figure 3, etc. The figures on the tops of the keys in the series run from one to nine inclusive. The first series represents units, the second tens, and the third hundreds, etc. To add, it is merely necessary to touch on the machine the numbers to be added; thus, if we have 5,673 plus 932, we touch the figure 5 in the fourth series, 6 in the third, 7 in the second, and 3 in the first, when 5,673 will be shown on the register; we next touch 9 in the third series, 3 in the second, and 2 in the first, when the sum of the two numbers, 6,605, will be shown by the register. This operation can be continued until the limit of the machine is reached, which in the standard size is 999,999,999.

Subtraction, multiplication, and division can each be as rapidly and as easily performed.

By again referring to the cut, it will be seen that at the front of the machine is a plate in which are a number of square openings, which is called the register plate. At these openings are shown all results by numeral wheels, which are below the plate and which stand side by side on the same shaft, and each of these numeral wheels is acted upon by its keys direct and also by the carrying part of the numeral wheel next lower in order, something that has never been practically accomplished before in any mathematical calculator operated by keys. The carrying mechanism in this machine is entirely independent of the keys struck, and the power required for carrying is gradually accumulated and automatically released at the proper moment, therefore requiring no additional effort to depress the key when, through the operation of the carrying device, the next numeral wheel in order above has to be moved, than when such is not the case; therefore, when a succession of nines occur on the register, and a key is struck in one of the lower orders, it is impossible to discover that any more power is required than when one nine only appears on the register. In this machine two positive stops are employed for each numeral wheel, one to prevent over-rotation of the numeral wheel under the impulse of the key stroke, and the other to prevent over-rotation of the numeral wheel when actuated by the carrying mechanism. As there is no frictional device employed to prevent over-rotation, the machine always responds to a light touch on the keys; and as each numeral wheel is always in positive engagement with its controlling devices, absolute accuracy is insured at all times. It having been stated that the carrying device is independent, it will be at once seen that when a key of one of the higher orders is struck, the carrying device of the next lower order is at once released, allowing the numeral wheel on which the key struck acts to move independently of all numeral wheels lower in order. The result of any operation being obtained, the machine is returned to naught by depressing the lever which appears on the right and turning the knob above it until the figures seven appear on the register, when release the lever and continue turning the knob, and the machine will stop at the ciphers.

The comptometer is being manufactured by Messrs. Felt & Tarrant, 52, 54, and 56 Illinois Street, Chicago.



FELT'S IMPROVED CALCULATING MACHINE.

The Buried Forests of New Jersey.

An industry the like of which does not exist anywhere else in the world furnishes scores of people in Cape May County, New Jersey, with remunerative employment, and has made comfortable fortunes for many citizens. It is the novel business of mining cedar trees—digging from far beneath the surface immense logs of sound and aromatic cedar. The fallen and submerged cedar forests of Southern New Jersey were discovered first beneath the Dennisville swamps 75 years ago, and have been a source of constant interest to geologists and scientists generally ever since. There are standing at the present day no such enormous specimens of the cedar anywhere on the face of the globe as are found embedded in the deep muck of the Dennisville swamps. Some of the trees have been uncovered measuring six feet in diameter, and trees four feet through are common.

Although ages must have passed since these great forests fell and became covered many feet beneath the surface, such trees as fell, according to the scientific theory, while they were yet living trees are as sound to-day as they were the day of their uprooting. Such trees are called "windfalls" in the nomenclature of the cedar mines, as it is thought they were torn up by the roots during some terrible gale of an unknown past. Others are found in the wreck that were evidently dead trees when they fell, and to these the miners have given the name of "breakdowns." The peculiar action of the wind and water in the swamp has kept these breakdowns in the same stage of decay they were in when they fell, as the same agency has preserved intact the soundness of the living trees.

The theory of those who have made this mysterious collection of buried cedar trees a study is that they in some unknown age formed a vast forest that grew in a fresh water lake or swamp that covered this portion of New Jersey, the properties of the soil of which were necessary to the forest's existence. According to Clarence Deming and Dr. Maurice Beasely, eminent geological authorities in Southern New Jersey, the sea either broke in upon the swamps or the land subsided and the salt water reached the trees. This destroyed the life of many of them, and subsequently some prehistoric cyclone swept over the forest and leveled it to the earth. The heavy trees gradually sank into the soft soil of the swamps until they reached the substantial earth or rock beneath it, where they reposed, unknown and undisturbed, until their presence was accidentally discovered in 1812. Ever since then the logs have been mined, and have been an important factor in the commercial and business prosperity of South Jersey.

The buried forest lies at various depths in the swamp, and the uncovering of the trees or working the "cedar mine" is done in a very simple and easy manner. The log miner enters the swamp and prods in the soft soil with a long, sharp iron rod. The trees lie so thickly beneath the surface that the rod cannot be pushed down amiss on its testing errand, for the prodding is not so much in search of a tree as it is to test whether the tree is a "windfall" or a "breakdown." When the prod strikes the log, the miner chips off a piece with the sharp point of the tool, which brings the chip or splinter to the surface when drawn out of the muck. By the appearance and order of this chip the miner can tell at once whether the tree he has tested is a sound or a dead one. If the former, he quickly ascertains the length of the trunk by prodding along from one end of it to the other.

That ascertained, he proceeds at once to raise the log from its hidden bed. He works down through the mud a saw similar to those used in sawing out ice in filling an ice house. With this he saws the log in two as near the roots as he cares to. The top of the tree is next sawed off in the same way, and then the big cedar stick is ready to be released from its resting place. A ditch is dug down to the log, the trunk is loosened by cant hooks, and it rises with the water to the surface of the ditch. A curious thing is noticed about these logs when they come to the surface, and that is that they invariably turn over, with their bottom sides up. After mining, the log is easily "snaked out" of the swamp and is ready for the mill or factory.

These ancient trees are of a white variety of cedar, and when cut have the same aromatic flavor intensified many degrees that the common red cedar of the present day has. The wood is of a delicate flesh color. One of the mysterious characteristics of these long-sunken trees is that not one has ever been found to be waterlogged in the slightest. It is impossible to tell how many layers deep these cedars lie in the swamps, but it is certain that there are several layers, and that with all the work that has been done in constantly mining them during three-quarters of a century, the first layer has not yet been removed from the depths. At some places in the Dennisville swamp the soil has sunk in for several feet and become dry, and there the fallen cedars may be seen lying in great heaps, one upon the other. No tree has ever been removed from the Dennisville swamp from a greater depth than five feet, but outside the limits of the swamp they have been found at a great depth, which shows the correctness of the deep-layer theory. Near the shore of the Delaware, eight miles from Dennisville, white cedar logs have been exhumed from a depth of 12 feet. At Cape May, 20 miles distant, drillers of an artesian well struck one of the trees 90 feet below the surface. It was lying in an alluvial deposit similar to the Dennisville swamp. Another log was found at Cape May 20 feet below the surface, and a third at a depth of 70 feet. These deeply buried logs were among the largest ever brought to light, and their location so far away from the Dennisville marsh indicates the great extent of that ancient forest area.

The uses to which the cedar logs are put are many. The principal use is the making of shingles and staves. The longevity of articles made from the wood is shown in shingles, tubs, pails, and casks made from it over 70 years ago, and which have yet to show the slightest indication of decay. The shingles and staves are worked into shape entirely by hand, the only machine work that is permitted in manipulating the cedar logs being the sawing of them into proper lengths for the uses to which the lumber is to be put. The Dennisville cedar shingles command a price much higher than the best pine or chestnut shingles.

What it is in the amber colored swamp water and red muck at Dennisville that preserves these trees so that, after the lapse of centuries, their fiber is as clean and smooth and strong as it was when the green branches of the cedar were waving over the swamp is a mystery that scientific men have as yet been unable to solve. —*N. Y. Sun.*

The New British Rifle.

Experimental firing with the new British military rifle at ranges beyond 2,000 yards has given the following results. The targets were small field fortifications ten yards long. The firing, volleys by about thirty men, was almost wholly from direction, sighting being impossible, owing to the hazy weather; yet at 2,000 yards out of 370 shots there were 159 hits; from 367 shots at 2,400 yards there were 96 hits; and from 629 shots at 2,800 yards there were 104 hits. Penetration at the extreme ranges had been thought doubtful, but some bullets at 2,800 yards struck an iron target and were broken to pieces.

ENGINEERING INVENTIONS.

A car wheel and axle has been patented by Mr. John H. Smith, of Paterson, N. J. This invention provides means whereby one wheel will run independent of the other, producing less friction on curves and preventing strain upon the axle, the axle and attached wheels being of simple, durable, and economical construction.

A car coupling has been patented by Mr. Abraham G. W. Foster, of Whitesburg, Ga. It is so constructed that the coupling pin may be set to be automatically thrown into coupled position with a coupling link and the latter guided into place in the drawhead, providing also for the uncoupling of the cars without the operator going between them.

A safety appliance for car trucks has been patented by Mr. Gavin Rainnie, of Portland, New Brunswick, Canada. It consists of a heavy or strong bar bolted to the truck frame and bent to cause it to pass over the main stationary bolsters, being applied in such way as to keep the cars on their tracks in case of derailment, and to operate as a safety means in case of a broken rail.

AGRICULTURAL INVENTION.

A cultivator has been patented by Mr. Henry H. Hooker, of Wilmot, Kansas. The cutter blade is of approximately U-shape, with two cutting edges, the vertical side portions having adjusting apertures for the attachment of a bail with which the handle is connected, the blade being adjusted at any required angle, and the device being especially designed for cultivating garden vegetables, young onions, etc.

MISCELLANEOUS INVENTIONS.

An ironing table has been patented by Mr. Frederic A. Clark, of Newark, N. J. It is a table that is simple and durable in construction, and can be easily folded up, the invention covering various novel details in the construction and arrangement of parts.

A load elevator has been patented by Messrs. Jacob Lane and Nelson McPherson, of Gainsborough, Ontario, Canada. It is made with a combined drum and ratchet wheel of peculiar construction, the ratchet wheel being formed of inwardly tapering sections.

A truss pad has been patented by Mr. Edward W. Holt, of Brooklyn, N. Y. It is flexible and hollow, and adapted to be inflated with air, water, or other fluid, and has partitions in the interior of the pad whereby the inflating medium is kept from shifting materially.

A tether has been patented by Mr. George S. Sergeant, of Greensborough, N. C. It is made with a standard or stake on which a bracket or carrier is supported, so that it may rotate on or be adjusted along the stake, in connection with a pole and a spring connection supporting the pole.

A sunshade for vehicles has been patented by Letitia V. Luce, of New Orleans, La. It is a simple and readily manipulated device whereby the eyes of the driver may be shielded from the sun, the device being such that it can be readily withdrawn and concealed when not in use.

A garment has been patented by Mr. Paul T. Forsyth, of Memphis, Tenn. This invention covers a garment provided at each side of the front opening of the skirt portion with pockets which may be slipped over the knees of the wearer in riding or driving, as a protection against cold, winds, or storms.

A new composition for dyeing aniline black has been patented by Mr. Benjamin F. Cresson, of Philadelphia, Pa. It consists of water, chlorate of potash, sal ammoniac, sulphate of copper, nitrate of iron, aniline oil, muriatic acid, and tartaric acid, compounded in a manner and in proportions prescribed.

A double clamp has been patented by Messrs. William Carroll and Charles A. Hill, of Columbus, Ohio. It is for holding the doors of stoves in place on the stove casing while fitting on the hinges, pintles, etc., the clamp rods being held within casings in such way as to be acted upon by coiled springs.

An adding machine has been patented by Mr. Charles B. F. Lincoln, of San Francisco, Cal. This invention covers various novel features in the combination and arrangement of parts in an adding machine, whereby greater simplicity, convenience in use, and rapidity in operation are attainable than usual.

An automatic fan has been patented by Mr. Henry Goodspeed, of San Marcos, Texas. It is adapted to be connected to and suspended from the ceiling of a room in any desired position, the invention covering a peculiar construction and arrangement of parts, the fan to be operated by a suitable driving power.

A foot rest for chairs has been patented by Mr. Henry S. Parker, of Peterson, Iowa. It is especially adapted for use in connection with infants' high chairs, the invention covering a novel construction which may be conveniently attached to chairs of different widths, and also conveniently adjusted vertically.

A life preserver has been patented by Mr. Samuel Pemberton, of Alpena, Mich. It consists of two hollow belts connected together at one side by a tube and at the opposite side by a bellows, the bellows communicating with one of the belts and forcing air through both of them, the apparatus forming an inflatable harness.

An improvement in stereotyping has been patented by Mr. Lucius Goss, of New York City. This invention covers a method of casting and cutting plates of single column width, to be used to extend across two or more columns of a newspaper page, to facilitate the arrangement of pictures in the cast matter used by "ready print" newspapers.

A sash balance has been patented by Mr. Charles Fowler, of East Springfield, N. Y. The invention consists of certain arrangements of wires or cords in the window or sash frame and friction pins in the sash, with means for taking up any slackness of the hanging wires or cords as it occurs, ordinary pulleys and weights not being necessary.

A bag holder and fastener has been patented by Mr. Aloysius, of Loretto, Kansas. Combined with the bag is a suspension and fastening wire detachably secured to the mouth of the bag at one side, and formed with eyes at its ends, making a support for the bag when not in use which may be employed to fasten the bag after it is filled.

A battery electrode has been patented by Mr. Horatio J. Brewer, of New York City. The conductor, of carbon or other suitable material, is made with projections on its surface, an envelope or bag being drawn over the projections to form pockets, in which a granulated or powdered electro negative material is packed between the conductor and the envelope.

A fishing reel has been patented by Mr. Michael Cashin, of New York City. The reel is made with an operating mechanism designed to automatically wind up the line when a fish is hooked, the mechanism being so arranged that the control and winding and unwinding of the line may be readily effected.

An ironing machine has been patented by Mr. Frank Corbett, of New York City. This invention relates to ironing machines in which the revoluble ironing rollers are hollow, to receive the steam or other agent by which they are heated, the invention covering novel features of construction and the arrangement of parts.

A grapnel tongs has been patented by Mr. Thomas J. S. Davis, of Davis Wharf, Va. It is specially designed for loosening and raising oysters in deep or shallow water, and consists of two rakes adapted to swing toward and from each other, racks being connected with the rakes, and a gear wheel, drum, and ropes, for operating the racks and rakes.

A folding bed has been patented by Mr. John S. Roe, of Chicago, Ill. Combined with a casing and racks secured to its sides are toothed wheels on the sides of the bed, rods pivotally connected to the casing and to the bed, with a spring for holding the toothed wheel in engagement with the rack and the bed in a vertical position, with other novel features.

A tin can has been patented by Mr. Francis J. Marmion, of New York City. It is made of but few parts, easily jointed together, forming a double seam on the sides of the can and on the joining edges of the flanges or sides of the steeple-shaped top, whereby the can is made very strong, the double joints acting as braces to all the sides and the top of the can.

A gas pressure regulator has been patented by Messrs. John W. Carter and Joseph Miller, of Greenfield, Ind. This invention covers a novel construction of the supply valve and its seat, with means whereby the valve is automatically opened and closed, reducing to a minimum the pressure in the service pipe, the device being also adapted to serve as a steam or liquid pressure regulator.

An automatic advertising device has been patented by Mr. Edward C. Magnus, of Chicago, Ill. This invention covers a novel mechanism of springs and weights for utilizing the jolting, trembling and swinging motion of public vehicles, as cars, stages, etc., or frames of any kind to which a sign may be attached, to give motion to parts or the entire surface of advertising cards or devices.

A gas check for waste pipes has been patented by Mr. Henry B. Eareckson, of New York City. It is for use on the waste pipes of wash basins and other water fixtures, to permit the discharge of the waste water while automatically preventing the backflow of sewer gas, a self-closing flap valve opening by the pressure of the waste water, and closing tightly by the pressure of gas from the drain.

A window shade attachment has been patented by Mr. Charles Niss, Jr., of Milwaukee, Wis. It is intended for window shades known as Venetian blinds, in which transverse slats are strung upon cords, the attachment furnishing a simple and convenient means for adjusting the slats, and to provide for the ready fastening of the blind to the window casing to prevent its being blown inward when the window is open.

A check hook has been patented by Mr. Clinton C. Lovejoy, of Bethel, Me. The hook proper is connected to a spring of sufficient strength to return the check rein, being retained by a suitable device connected to the frame of the hook, and also adapted by means of a rear hook to be thrown off from the retaining device for unchecking the horse, whereby a driver may check up and uncheck the horse without leaving the vehicle.

A pipe joint has been patented by Messrs. Francois Jos. Garnier and Nicolas Cure, of Brussels, Belgium. Combined with the plain flanged ends of two pipes connected by screw bolts is a thimble having an external under-cut flange, the thimble fitting loosely in the bore of the pipes, and the flange intervening between the abutting edges, a soft packing being placed between the under-cut faces of the flange and the pipe ends.

A stump puller has been patented by Mr. James M. Moore, of Union City, Tenn. It has sills with parallel runners, a derrick on one sill and a standard bearing on the other, to which is fulcrumed a draught-beam lever, there being a lever-hoisting tackle on the derrick and a brace jointed loosely at its ends to the top of the derrick and to the other sill, whereby a constant power may be employed, with the force the greatest and the speed the slowest at the commencement of the pull.

An apparatus for teaching arithmetic has been patented by Messrs. Ignatius L. Unterbrink, of St. Rosa, and Albert G. Vandenbrock, of Cassella, Ohio. It is made with a casing having two vertical series of horizontally aligned polygonal rollers having numerals on their faces, and an intermediate vertical polygonal roller separating the series and having algebraic signs on its faces, with other novel features, designed to save time and labor for both teacher and pupil.

An apparatus for automatically regulating the flow and temperature of fluids has been patented by Mr. George A. Gustin, of Washington, D. C. It consists of a valve operated by electro-magnets and a battery, in connection with a thermostat and a weight, so that the thermostat can be set at any desired temperature, the thermostat being operated by the temperature of the water it is intended to control, and connected electrically with one or more of the magnets which operate the valve.

A machine for wiring corks in bottles has been patented by Mr. Benjamin Adriance, of Brooklyn, N. Y. This invention covers an improvement on former patented inventions of the same inventor, and consists principally in means for giving to the intermittingly rotated spindle a varying velocity of rotation, and in means for locking the spindle against axial movement while it is being moved longitudinally, together with means for operating the twisting pliers and clamping or tension jaws for holding and releasing the wires.

NEW BOOKS AND PUBLICATIONS.

THE ELEMENTS OF ELECTRIC LIGHTING. Including electric generation, measurement, storage, and distribution. By Philip Atkinson, A. M., Ph.D. 260 pages, 12mo, 104 illustrations. Price $1.50.

This work, although it has been condensed into a volume of less than 300 pages, covers very fully the field of electric lighting. It is intended as a popular handbook, and is free from unnecessary technicality and mathematical formulæ. Beginning with the theory of the dynamo, it covers the ground of its development until the complicated form is reached as represented by the types used in our large plants. The subject of the electric lamp, both arc and incandescent, is treated in the same way, and the different systems, as represented by the Swan, Weston, Edison, Sawyer-Man lamps and others, are described and represented. A chapter is devoted to the subject of the secondary battery and its theory and practicability as a means of storing power is treated of. There is also a chapter on the method of distributing the electricity from a central station to the consumer or for use in lighting towns and cities. In this connection is discussed series and parallel installation, the electric regulator, the meter, and the different appliances that have become necessary with the introduction of the system of general illumination. The ground covered by this work is extensive, but the subject has been skillfully handled, and as a handbook for the practical mechanic, the beginner in electrical subjects, the student, or the general reader, it will be found of great value.

SWINE PLAGUE, WITH ESPECIAL REFERENCE TO THE PORCINE PESTS OF THE WORLD. An etiological, pathoanatomical, prophylactic, and critical contribution to general pathology and state medicine. By Frank S. Billings. Lincoln, Neb.: Journal Company, State Printers. 1888. Pp. 414.

This monograph, issued by the University of Nebraska, is the second report from the patho-biological laboratory in charge of the distinguished author. The subject is treated very fully, but, from its nature, it does not lend itself to a review. The work may be noted, however, as attractively printed and bound and illustrated by a number of plates showing the appearance of the affected parts and of the micrococci characteristic of the diseases.

A TREATISE ON THE LAW OF BUILDING AND BUILDINGS: ESPECIALLY REFERRING TO BUILDING CONTRACTS, LEASES, EASEMENTS, AND LIENS. By A. Parlett Lloyd, of the Baltimore Bar. Boston: Houghton, Mifflin & Co. New York, 11 East Seventeenth Street. The Riverside Press, Cambridge. 1888. Pp. li, 618. Price 50 cents.

This work is strictly a law book, a manual of building law. It claims to be the first work upon its subject. Although it may seem rather designed for lawyers, it is one of those books that should be in the possession of all interested in building, as, owing to its extensive index, digests of decisions, and forms of agreement, it will be appreciated by such. It is distinctly American, and American decisions will be found liberally quoted. Mechanics' liens are very extensively treated, and chapters devoted to building contracts, building leases, etc., are given.

The Proceedings of the Michigan Engineering Society, at its ninth annual convention, in January last, constitute an octavo pamphlet of 144 pages, published by Messrs. Ihling Bros. & Everard, of Kalamazoo, and sold at 50 cents. Similar reports can be had of former conventions, since 1882, in which many valuable papers are preserved in permanent form for convenient reference.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) E. F. B.—You will find the subject of japans treated in Spons' "Workshop Receipts," and in the "Painter's Encyclopedia." We can supply you with either for $2.

(2) O. W. K. asks: 1. How many cubic feet of water gas is required to give the same heat as one pound of ordinary bituminous coal? A. About 15 cubic feet of gas. 2. Also how many cubic feet of air is required to effect the perfect combustion of a cubic foot of gas? A. From 7 to 12 cubic feet of air.

(3) H. A. E. asks: 1. Is common stovepipe iron without the glaze on it just as good as Russia iron with the glaze on it for the magnet cores of simple electric motor? A. Almost as good. 2. How many carbons (each being one-half inch diameter by five inches long) will it take to get the same carbon element as you described, five by seven inches? A. Ten. 3. How many batteries will it take, each holding one pint of electropoion fluid, to drive the motor? A. About 20, arranged five in parallel. 4. Can the brush-holding disk be made out of wood just as well? A. It can be made of wood. Vulcanite would cost 25 to 50 cents.

(4) G. D. writes: I have an underground ice house with close board floor above. It has become so charged with carbonic acid gas, arising from the leaves with which the ice is covered, that we cannot go down with a lamp, which immediately dies out. I have tried throwing in quicklime, which does very little good. Can you tell me how to expel the gas, as it is very unsafe to go in? A. Slake the lime thoroughly with water before putting it in the ice house. Use the lime while still fresh. It is very dangerous to descend into a place that cannot support the combustion of a lamp.

(5) H. J. D. asks by what process oil and water can be mixed. A. By dissolving gum tragacanth or some similar substance in the water a mechanical mixture known as an emulsion can be produced. A caustic alkali such as soda will decompose the oil, and so effect a "destructive" mixture.

(6) E. P. asks if cigarettes are made with the hands like cigars or if made by machinery. A. They are made both ways. A good operator will make 1,200 per day by hand.

(7) H. W. S. asks: Could I run a dynamo with a one horse power water motor, and have it light a private house with incandescent lights to the extent of about 175 candle power? What dynamo should I use? A. A one horse power motor would not be sufficient for your purposes. Double that size would be preferable. Use the dynamo described in SUPPLEMENT, No. 600; wind three or four extra layers on the field and place it in shunt.

(8) H. D. asks what processes are used to refine lard, or where he can find information on this subject. A. The fat, as fresh as possible, is treated in a boiler with steam at 60 to 80 pounds for 6 or 8 hours. The separated lard is floated off by adding water to the boiler, or all is run off together and the lard separated when cold.

(9) F. W. B. asks: 1. Can the armature core be made—for the 8 light dynamo—of iron wire in the same manner as the drum armature given for the hand power machine and give as good results as the ring armature? A. Yes. 2. Why should the iron wire be varnished? A. To avoid metallic contact. The object of dividing a core is to avoid Foucault currents. If the parts were in contact, the core would be practically solid, and the dynamo would be of much lower efficiency.

(10) J. C. F.—Gas made from kerosene is entirely too heavy for ballooning purposes. Hydrogen may be made by acting on zinc or iron scrap with acid or by passing steam through a tube filled with white cut iron scrap. This is a very buoyant gas, but leaks out rapidly from the balloon.

(11) F. P. A. asks: Will you please tell me how to prepare and apply the black enamel used on bicycles? A. The best quality of japanning put on by oven process is employed. For description of same we refer you to "Workshop Receipts," vol iii., which we can send you for $2 by mail.

(12) J. J. C. asks: 1. Please give me the receipt for a good baking powder, and directions for making. A. Mix together perfectly dry 83 parts by weight of bicarbonate of soda and 188 parts of acid tartrate of potash (cream of tartar). 2. I have a pint bottle of Stephens' commercial ink which writes very lightly. What kind and what quantity of nut galls shall I use to darken it? A. We would not advise you to add anything to the ink. You would do better to buy a new bottle. 3. What must I mix bronze powder with so as to be able to use it as gold paint? A. Copal varnish. 4. I have an elegant four in hand scarf which has been soiled by wearing in hot weather; how can I make it fit to wear? A. Try sponging with ammonia and alcohol. It is doubtful if you can remove the stains.

(13) M. W. S. asks: How is absorbent cottton, used by surgeons, made? A. Take of the best quality of carded cotton batting any desired quantity, and boil it with a 5 per cent solution of caustic potassa or soda for one-half hour, or until the cotton is entirely saturated with the solntion, and the alkali has saponified all oily matter. Then wash thoroughly, to remove all soap and nearly all alkali, press out the excess of water, and immerse in a 5 per cent solution of chlorinated lime for 15 or 20 minutes, again wash, first with a little water, then dip in water acidulated with hydrochloric acid, and thoroughly wash with water, press out the excess of water, and again boil for 15 or 20 minutes in a 5 per cent solution of caustic potassa or soda; now wash well, dipping in the acidulated water and washing thoroughly with pure water. Afterward press out and dry quickly. The amount of loss by this process is practically 10 per cent. A sample of 360 grains lost, on boiling with alkali and bleaching, 15 grains, or 4·17 per cent, and 270 grains of this bleaching sample lost, on again boiling with an alkali, 14 grains, or 5·18 per cent, a total loss of 9·35 per cent. When properly made, if dropped into water it should immediately become saturated and sink to the bottom.

(14) T. P. H. asks: 1. Why should the combined resistance of all the relays on a telegraph line equal the resistance of the line and battery? A. Any such rule is empirical. The correct method is to have the resistance of the entire external circuit line relays and all equal to the resistance of the battery. By applying Ohm's law it will be found that with this arrangement the maximum current is obtained with the minimum number of cups. But for economy of chemicals the resistance of the battery should be as low as possible. 2. What is the best elementary work on electricity and the telegraph? A. We recommend, and can supply by mail, Larden's "Electricity for Schools and Colleges," price $1.75; also Thompson's "Elementary Electricity," price $1.25; also "Electricity and the Electric Telegraph," by Prescott, in two volumes, price $5.

(15) C. W. asks: 1. What acids will combine with asbestos? A. No acid will combine with it. 2. I wish to polish some steel plates, 2½×3×$\frac{1}{16}$ of an inch thick, so that they are perfectly plane on one side. In what way can I do this the easiest? A. Plane them as true as possible, then grind them with emery in sets of three, rubbing first plate against second, and then third against first and second until finished, so as not to grind them in pairs. 3. Be kind enough to tell me what is the powder inclosed. I think it is a carbonate of something, and have not the apparatus to fully test it. A. The powder is a carbonate. Analysis will cost $5. 4. Can you furnish me with a new book called the "Techno Chemical Receipt Book"? A. We can send the "Techno-Chemical Receipt Book," by mail, for $2.

(16) A. B. asks: Is there anything that will make the ink that is used with rubber stamps indelible when used to stamp linen? A. Probably printer's ink is the most available. Or try the following: 100 gr. hydrochlorate aniline, 60 gr. sodium chlorate, 3½ oz. water, ½ gr. vanadate of ammonia. Collect and dry the precipitate and make into paste with gum arabic, water, and glycerine.

(17) J. L. B. asks for the best way to test acetic acid. A. Test acetic acid either by acidimenting with standard solution of alkali, or less perfectly by specific gravity. We refer you to Dussauce's "Treatise on Vinegar," price $5.

(18) W. V. D. asks: What are the cross hairs in instruments for surveying and leveling made of, and how put in? A. Spider web or unspun silk fibers or fine platinum wire are used. They are cemented across a ring which is secured within the tube of the telescope.

(19) T. G. P. asks: What is the correct pronunciation of dynamo and dynamite? A. Dina'mo, di'namite, the first syllable pronounced in both cases short like "bit."

(20) F. S. asks: What process is the best to fill up the pores of Portland cement tiles or artificial stones? A. We can recommend no process that would be thoroughly satisfactory. Melted paraffine might be tried applied to the tiles while warm, or the tiles might be washed with or dipped in cement and water mixed to the consistency of cream.

(21) Acekay writes: I have a tortoise shell watch chain, from the links of which the polish is worn. How can it be conveniently repolished? Also what is the general process of finishing and polishing tortoise shell? A. Tortoise shell is finished by scraping. Then it is polished with pulverized charcoal and water on a woolen cloth perfectly free from grease. This is followed by water and washed chalk or whiting, the article being moistened with vinegar. Finally it is hand-rubbed with dry whiting or rotten stone. From above description you can tell how to treat your chain.

(22) W. F. S., Jr., asks: Can iron or steel be deposited on any of the other metals? Also, would it be possible to plate a worn bearing with iron or steel? A. Yes; see SCIENTIFIC AMERICAN, June 9, 1888, p. 359, and SUPPLEMENT, No. 605, which we can send by mail for 10 cents. It would be doubtful if it would be of practical use.

(23) A. A. S. asks: 1. In experimenting with carbon oil from petroleum would there be any danger of getting an explosion with acids and the oil. A. There is not much danger of an explosion, though it is a possibility. 2. Can you give the characteristics of Lima, Ohio, crude oil? A. In early wells the oil had a sp. gr. of 36° B., later it has reached 37° and 38° B., and in one instance (McCullough well) 41° B. It contains a large percentage of offensive sulphur compounds. It is claimed that it yields 65 per cent of completely deodorized illuminating oil. For analysis address David T. Day, Esq., United States Geological Survey, Washington, D. C. 3. What will precipitate lime from a solution? A. It depends on the form in which it is present. Oxalate of ammonia, a poison, is the universal precipitant. When the lime is in solution as bicarbonate, boiling will do it; when as sulphate, alcohol will answer.

(24) J. P. E. asks: Can beeswax be plated with nickel, and if so, how should I proceed? A. Coat it with plumbago, dust on fine iron powder, immerse in a sulphate of copper bath for a few minutes, and then plate with battery.

(25) C. S. P.—Exposure to the sun under glass is said to bleach ivory. For binoxide of hydrogen bleaching we refer you to SUPPLEMENT, No. 339, which we can send you by mail for ten cents.

(26) G. A. J. asks: 1. What is used to put a polish on brass, such as hanging lamps and the like? A. Shellac dissolved in alcohol. Great care and absolute cleanliness is needed in applying it. The metal after polishing with rotten stone and oil must be washed and dried and shellacked while hot. 2. What is good to remove fly specks from brass? I have tried soap and water, gasoline, kerosene, etc., but have not succeeded. A. Rub off with ground pumice, followed by rotten stone, and apply shellac as above. 3. Is there any lubricating oil void of acid? A. Yes. 4. Does an ounce of steam at 500° occupy more space than at 212°? A. Yes; about 50 per cent more volume.

(27) M. N. writes: Is it necessary to have the windows of a school room (heated by hot air, with ventilators around the sides near the floor) down at the top? It is very uncomfortable to have the windows down a foot or more, but our teacher insists on having them so. A. We favor ventilation, and believe that your teacher is right.

(28) C. C. G. asks for a recipe that will produce an innocent green color, with linseed oil. A. Use chrome green, a mixture of lead chromate and Prussian blue.

(29) T. J. asks: Can a molecule exist apart from gravity? A. Gravity is an inherent property of matter. If all matter were annihilated except one molecule, it would possess gravity, although nothing would exist for it to react upon. It would be an analogous case to the firing of a cannon in the midst of the desert of Sahara, where sound would be produced, though there would be no being to hear it.

(30) Old Reader asks how to clean out paint brushes that are hard with old paint. A. Soak the bristles only in washing soda and wash out with hot water. Soaking in turpentine may be sufficient, and if so, will be less trying to the brush.

(31) T. S. C. asks: What can I put in gum arabic to keep it from souring and at the same time keep it neutral? And also to prevent it from cracking when mixed with color, as I want to use it for coloring photos. I have tested most everything without effect. A. Glycerine or honey will prevent cracking. A very little oil of cloves will preserve it from turning sour.

(32) L. M. W. asks: I would like to learn how to take tin types. Could you give formulas for the sensitive developing and fixing baths, also how how to repair and place the film on the plate? A. See the very complete formula published in "The Ferrotype, and How to Make It," which we can supply for 50 cents.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

October 9 1888

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Adding machine, C. B. F. Lincoln 390,788
Alarm. See Burglar alarm.
Alloy, J. Hurych 390,972
Auger, H. Burdick 390,749
Axle box lid, car, Morris & Lawrence 390,981
Axle boxes, dust guard for car, J. Stier 390,991
Bag holder and fastener, A. G. Blincoe 390,643
Bar. See Grate bar.
Barley flakes, Farwell & Rhines 390,849
Barley flakes, making, Farwell & Rhines 390,850
Battery. See Galvanic battery.
Batting, machine for making cotton, Walker & Williams 390,923
Bed, folding, Alexander & Lynn 390,640
Bed, folding, J. S. Roe 390,805
Bell pull, electric, P. A. Harris 390,778
Beverage shaking and mixing machine, B. F. K. Jennings 390,974
Bicycle, F. M. Drake 390,952
Bicycle, W. F. Stevens 390,916
Billiard cue and tip, F. P. Hull 390,860
Binder, A. K. Owen 390,984
Bit gauge, J. E. Windle 390,936
Blast pipe, Appleby & Robinson 390,937
Block. See Pulley block.
Board. See Ironing board.
Bobbin winding machine, C. F. Wickwire 390,932
Boiler cleaner, Lane & Davies 390,866
Boot or shoe uppers, implement for fluting, C. T. Wood 391,002
Bottle rinsing machine, J. Masson 390,688
Bottles, machine for wiring corks in, B. Adriance 390,742
Box. See Fare box. Journal box.
Box or canister, A. F. Fitz Gerald 390,763
Brake handle, B. L. Wright 391,004
Brake shoe, J. A. Smithhisler 390,914
Brick machines, device for breaking up the laminations of the clay in screw, C. D. McClellan ... 390,879
Brush, L. Strickel 390,715
Brush heads, machine for boring, A. C. Estabrook 390,956
Buckets, cover for sap, H. Walcott 390,728
Buildings, construction of fireproof iron, E. J. Weston 390,732
Bureau, D. C. Clapp 390,840
Burglar alarm J. G. Schuirmann 390,989
Burner. See Gas burner.
Bustle, Jeffery & Stern 390,973
Butter worker, Pennebaker & Ross 390,700
Button, H. F. Hambruch 390,855
Button, R. Liebmann 390,869
Button setting tool, E. H. Taylor 390,818
Cable grip, R. A. McLellan 390,882
Can. See Tin can.
Cane, walking, J. E. Hale 390,961
Car buffer, F. A. Fox 390,958
Car coupling, D. Bellon 390,944
Car coupling, A. G. W. Foster 390,766
Car coupling, J. H. Weaver 390,827
Car, dump, L. J. Lewis 390,867
Car heater, E. Collins 390,649
Car heater, G. M. Edwards 390,953
Car, railway, W. Klinker 390,865
Car, stock, R. Wills 390,935
Car ventilator, C. P. Weiss 390,828
Car wheel and axle, J. H. Smith 390,811
Car wheels, making, J. Munton 390,695
Cars, heating and cooling railway, H. Penoyer ... 390,701
Carbon contact or commutator brush, C. J. Van Depoele 390,921
Card, feeding a, P. J. Connelly 390,947
Carpet fastener, E. R. Taylor 390,720
Carriage, baby, H. C. Seip 390,909
Carriage wrench, F. A. Wegner 390,731
Casting hooks into eyes, C. L. Sage 390,907
Casting metal ingots, J. Illingworth 390,861
Centering gauge, C. Gage 390,658
Chairs, foot rest for, H. S. Parker 390,801
Chimney cap, H. M. Hansen 390,857
Chlorine, manufacture of, A. R. Pechiney 390,895
Chuck, self-oiling punch, D. Warner 390,925
Churn closure, J. McDernaid 390,689
Cigar bunching machine, J. J. Bach 390,940
Cigar seller, C. O. Cole 390,841
Clamp. See Double clamp.
Cleaner. See Boiler cleaner. Flue cleaner. Window cleaner.
Clock, alarm, A. M. Lane 390,786
Clothes pounder, W. Baynes 390,744

Clutch mechanism, locking device for, A. H. Merriman 390,886
Collar fastening, J. R. Farrell 390,848
Combination gauge, W. B Little 390,780
Cork extractor J W Milam 390,691
Corn sheller, H A. Adams 390,831
Corn silking machine, J H. Cuskley 390,948
Corset, M. L. Geffs 390,771
Coupling. See Car coupling
Cranberry gatherer, D. Crowell 390,843
Cuff holder, A. W. Sawyer 390,908
Cultivator, H. E. Hooker 390,788
Cup. See Oil cup.
Cut-off and filter, rain water, W. W. Bays 390,943
Cutter. See Paper cutter.
Dental chairs, mechanism for lowering, L. Stuck 390,816
Dental linings, etc., foil for, J. A. Daly 390,950
Dental plate, foil lined, J. A. Daly 390,654
Desk, school, H. B. Hiteshew 390,859
Die. See Metal bending die.
Door lock, W. W. Pursel 390,704
Door check, S. H. Miles 390,887
Double clamp, Carroll & Hill 390,751
Draught attachment for vehicles, J. D. Miller 390,839
Draught equalizer, J. D. Willet 390,736
Draining lands, etc., W. Heaton 390,789
Dress form, C. H. Griffin 390,665
Dress form, A. S. Hall 390,668
Drier. See Fruit drier. Lumber drier.
Drill. See Twist drill.
Drugs, machine for compressing, Tinlin & Piatkowski 390,823
Drying house, N. S. Willet 390,737
Dust pan, Hebden & Thorpe 390,781
Dyeing aniline black, B. F. Cresson 390,842
Ear protector, H. J. Weldon 390,928
Egg cell, J. Wieland 390,735
Electric generator, multiple current, E. E. Ries 390,906
Electric generator, synchronizing, G. Westinghouse, Jr 390,930
Electric machine, dynamo, J. Emmner, Jr 390,955
Electric machine, dynamo, N. Tesla 390,721
Electric machines, apparatus for synchronizing alternate current dynamo, O. B. Shallenberger 390,912
Electric machines for electric distribution, coupling dynamo, O. B. Shallenberger 390,910
Electric translating devices, regulator for, O. B. Shallenberger 390,911
Electrical distribution, system of, O. B. Shallenberger 390,990
Electrically operative lock, G. S. Neu 390,795
Electro-dynamic machine, E. E. Ries 390,905
Electro-dynamic motor, E. E. Ries 390,904
Electrode, battery, H. J. Brewer 390,748
Elevator. See Load elevator.
Elevator, W. E. Nickerson 390,797
Elevator operating device, I. H. Venn 390,825
Engine. See Gas engine. Steam engine.
Extractor. See Cork extractor.
Fabric. See Knit fabric.
Fan, automatic, H. Goodspeed 390,663
Fare box, F. B. Brownell 390,946
Feed house for animals, E. M. Crummer 390,652
Feed rack, A. Hall 390,667
Feed water, apparatus for purifying, W. Webster 390,927
Fence, Howard & Ward 390,971
Fence, J. L. Symonds 390,995
Fence machine, picket, Odell & Hopper 390,983
Fence machine, picket, E. J. Youngs 390,739
Fencing, machine for making barbed, Jordan & Templin 390,975
File cutting machines, chisel holder for, H. Michel 390,793
Fire extinguisher, automatic, W. Neracher 390,696
Fishing reel, M. Cashin 390,752
Flue cleaner, W. H. Thomas 390,822
Fluids, apparatus for automatically regulating the flow and temperature of, G. A. Gustin 390,960
Foot power motor, J. M. Curtice 390,653
Frame. See Saw frame. Window frame.
Fruit drier, W. Grey 390,959
Furnace. See Garbage cremating furnace. Smokeless furnace. Sorghum furnace.
Furnaces, fore hearth for lead smelting, W. A. Koneman 390,785
Furniture, folding, G. H. Strong 390,815
Gauge. See Bit gauge. Centering gauge. Combination gauge.
Galvanic battery, D. Humphreys ..... 390,674 to 390,677
Garbage cremating furnace, A. Vivarttas 390,322
Garment, P. T. Forsyth 390,765
Garment supporter, B. J. Greely 390,775
Gas burner, Gill & Foley 390,660
Gas compressing and refrigerating apparatus, L. Block 390,836
Gas engine, H. K. Shanck 390,710
Gas log and fireplace, Q. S. Backus 390,743
Gas stand, portable, E. S. Rich 390,706
Gate. See Hatchway gate.
Gate, A. Miller 390,692
Gate, J. A. Miller 390,693
Gear teeth, cutter for cutting, T. S. Mower 390,982
Generator. See Electric generator.
Glass labels, furnace for heating, J. L. Dawes 390,844
Glass panels, metallic frame for, A. Nacke 390,794
Goring pattern, H. Gould 390,664
Grain binder, H. E. Pridmore 390,987
Grain binder, P. H. Saxman 390,709
Grain separator, W. L. Gilson 390,772
Grate bar, O. Reilly 390,902
Grip device, intermittent, W. E. Nickerson 390,796
Hair picker, H. Mundell 390,694
Hammock, swing, lounge, and table, combined F. H. Perry 390,985
Handle. See Brake handle.
Harness rosette, E. F. Pflueger 390,702
Harrow, spring tooth, A. A. Stimson 390,812
Hatchway gate, elevator, R. M. Kershaw 390,864
Heater. See Car heater.
Heel trimmer, J. H. Busell 390,750
Hitching post, L. Dow 390,951
Hoe, hand, P. Jacobus 390,679
Holder. See Bag holder. Cuff holder. Paper holder. Sash holder.
Hook. See Whiffletree hook.
Hoop planing machine, O. Schimansky 390,807
Hose bridge, Tucker & Keegan 390,920
House. See Drying house. Feed house.
Ice pick, rotary, W. Tunstill 390,998
Ingots, apparatus for forming compressed steel, W. H. Singer 390,810
Injector, E Ware 390,750
Insulator or bracket support for electric wires, T. E. Adams 390,741
Iron. See Polishing iron.
Iron into steel, converting cast, Hooper & Clark 390,969
Ironing board and iron stand, combined, W. H. H. Marcum 390,686
Ironing machine, F. Corbett 390,756
Ironing table, F. A. Clark 390,754
Jack. See Lifting jack.
Joint. See Pipe joint. Railway rail joint.
Journal box, T. McGrath 390,880
Knife. See Oyster knife.
Knit drawers, G. D. Munsing 391,007
Knit fabric, G. D. Munsing 391,005
Knit undershirt, etc., G D. Munsing 391,006
Knitting machine, circular, H. Heine 390,965
Knitting machines, electrical stop mechanism for, A. M. Newlands 390,891
Ladder and table, step, J. B Marsden 390,687
Lamp extinguisher, A. G. Hovde 390,970
Lamp, gas, C. Westphal 391,000
Lamp, incandescent electric, A. L. Reinmann 390,903
Lamps, globe for electric arc, W. W. Downing 390,846
Lamps, suspension device for, Bryant & Trumpbour 390,837
Lasting and sole laying machine, C. T. Wood 391,001
Latch, gate, H. L. Booth 390,645
Lathe for turning wooden spirals, V. Merklen 390,884
Levers, device for operating a set of, H. D Ganse, 390,768, 390,769
Life preserver, S. Pemberton 390,803
Lifting jack, N. Beauregard 390,834
Lifting jack, L. B. Holt 390,671
Lifting jack, A. A. Strom 390,813
Liquid meter, G. Teideman 390,918
Liquid separator, centrifugal, C. D. Shepard 390,711
Load elevator, Lane & McPherson 390,787
Lock. See Door lock. Electrically operative lock. Vehicle seat lock.
Lock, W. E. Sparks 390,915
Loom let-off mechanism, S. M. Hamblin 390,962
Loom temple, B. D. Stevens 390,714
Loom weft-stop mechanism, Hattersley & Hill 390,779
Lounges, head and back for, A. G. Phillips 390,703
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