SCIENTIFIC AMERICAN

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THE ELECTRIC SUBWAYS OF THE CITY OF NEW YORK.

On July 5, 1887, at the office of the Mayor of the city of New York, the Board of Electrical Control was organized, which is the successor to the Board of Commissioners of Electrical Subways. The name indicates its function; it is charged with the regulation of the distribution systems of the electrical supply, telephone, and telegraph companies of this city.

Both these organizations are the outcome of legislation looking to the placing underground of all the electric wires in this city. The Board of Electrical Control has supervision over both aerial and underground lines, and hardly anticipates success in having all wires placed underground, because in some parts of the city the demand for electrical service is so scant that it would not pay to place expensive conduits in such districts. In the present issue we illustrate the subways at present in use in this city, representing types which, it is fair to say, will probably be followed in general for many years to come. It consists of two elements, the manholes and the conduits.

The general system is the following: At regular distances throughout the streets where the conduit is to be placed, manholes are established. These are generally square or rectangular excavations lined with brick or iron. They are about 5 or 6 feet in diameter, and vary in depth according to the needs of the locality. There about 700 in the city, and hardly any two are identical in all respects. Some are rounded, six-sided, or diamond shape, although the rectangular outline prevails. A typical brick manhole is shown in Fig. 9.

They are capped with a heavy iron curb, and pro-

(*Continued on page 246.*)

Fig. 2.—FEEDING ELECTRIC LIGHT CABLES INTO THE DUCTS OF THE SUBWAY.

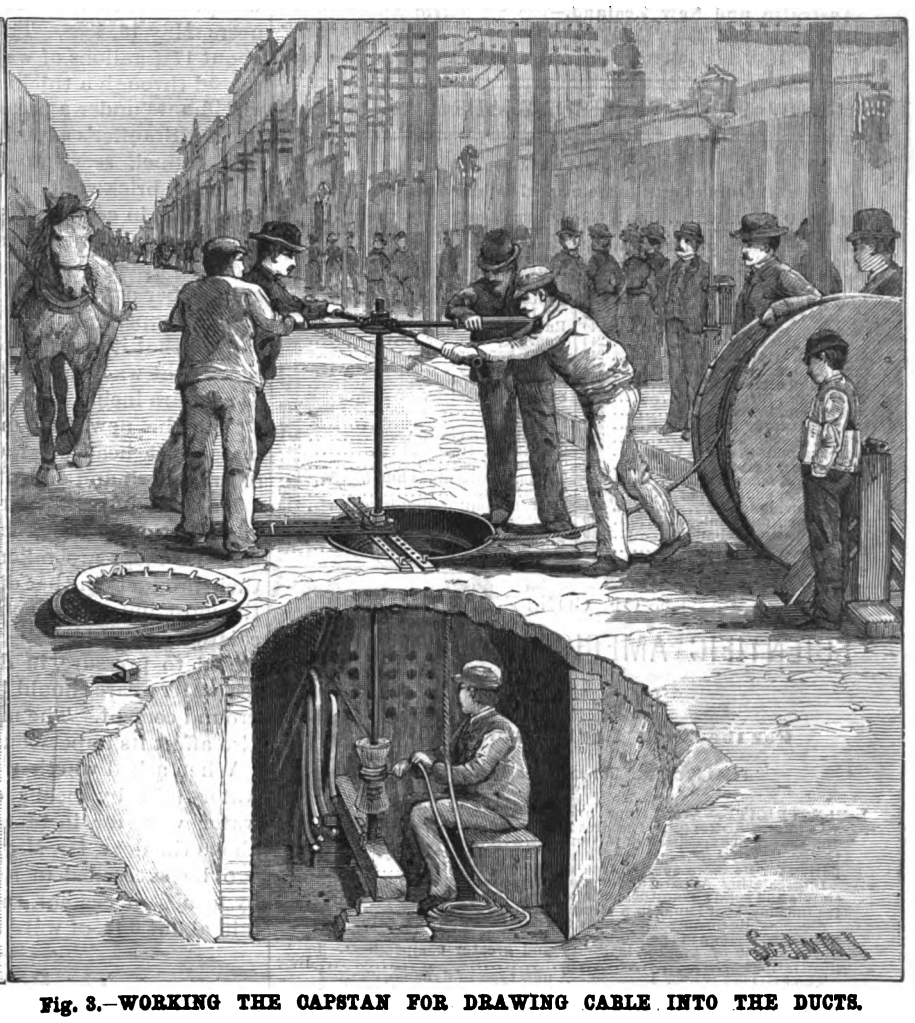

Fig. 3.—WORKING THE CAPSTAN FOR DRAWING CABLE INTO THE DUCTS.

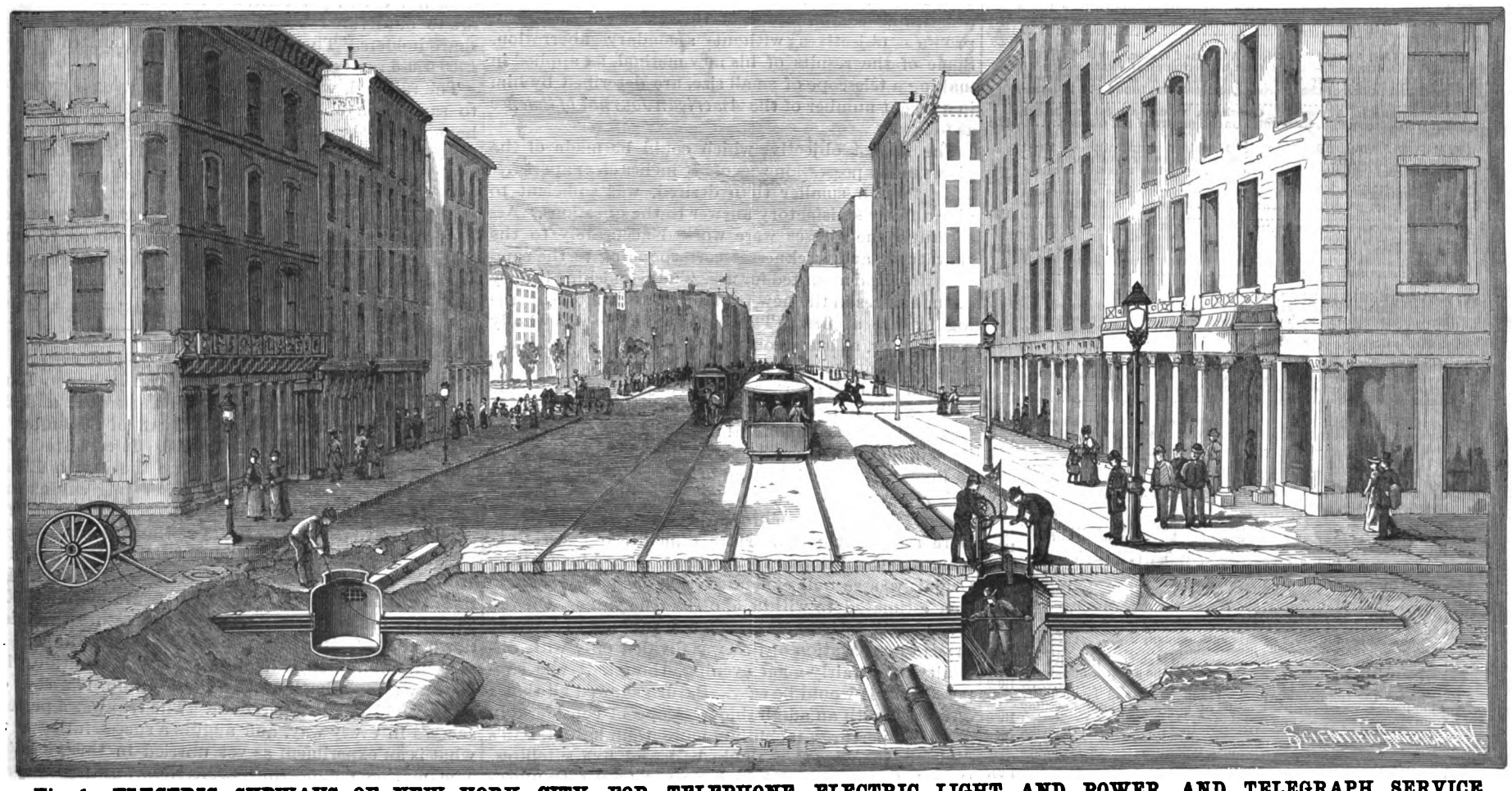

Fig. 1.—ELECTRIC SUBWAYS OF NEW YORK CITY, FOR TELEPHONE, ELECTRIC LIGHT AND POWER, AND TELEGRAPH SERVICE.

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NEW YORK, SATURDAY, APRIL 20, 1889.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 694.

For the Week Ending April 20, 1889.

Price 10 cents. For sale by all newsdealers.

Permeability of Cements.

At a recent meeting of the Engineers' Club of Philadelphia, Prof. L. M. Haupt presented some notes upon the permeability of cements and mortars, with a view of bringing out a discussion of this subject. He quoted from the recent report of the Board of Experts on the Washington Aqueduct tunnel. That report says:

"If all of the work could and would be faithfully fulfilled in accordance with the later specifications requiring backing by masonry laid in cement mortar, it would make the tunnel reasonably water-tight; yet it would not prevent all leakage absolutely, and it is difficult to foretell how much water would pass through.

"The head of the water in the tunnel varies from about 75 to 175 ft., and the pressure due to this head from 32 to 76 lb. per square inch. This is an internal pressure, tending to burst the tunnel outward—a direction of force which the tunnel lining is not well adapted to resist; and in an inelastic material like brick or cement, cracks are liable to be developed on the least yielding—which would be almost inevitable if any weak points were left in the filling. But even if it were all filled, it must be remembered that both brick and cement are permeable to water. Mr. James B. Francis made some recent experiments on the percolation of water through cement mortar, a record of which was presented to the American Society of Civil Engineers May 16, 1888. These experiments showed that about 17¼ gallons of water per square foot of surface passed through a thickness of nearly 16 in. of cement in 24 hours under a pressure of 77 lb. per square inch.

"Mr. Stauffer's experiments, made in the Dorchester Bay tunnel, serve to throw light on the leakage through brickwork. He constructed a bulkhead of brick, laid in cement, 4 ft. thick, in a tunnel 10 by 10 ft. He found that under a pressure of 72 lb. per square inch the water percolated through at the rate of 120,000 gallons per day, or 1,200 gallons per square foot.

"The experience on the Boston main drainage works proved that it was not practicable to build brick masonry that was water-tight under a pressure of 64 lb. per square inch.

"At the new Croton reservoir, New York, water under 36 ft. head was found to percolate through 26 in. of brickwork and 4 ft. of concrete."

Mr. Marichal said that the imperviousness of cements is a question of the greatest importance; yet it seems that no steps are taken by manufacturers to improve their products in that direction. The *fineness* is one of the most important considerations, and wherever percolation is prejudicial—as is the case in aqueducts subjected to pressure, in dams, and in works exposed to sea water—care should be taken to select a very finely ground cement. The manipulation of the mortar will also affect its imperviousness.

When asked whether it was possible to make cellars water-tight by means of cement, if the level of the water was, for instance, generally a couple of feet above the floor, Mr. Marichal answered that some years ago he succeeded in rendering perfectly water-tight, by means of cement, some cellars which used to contain about 6 ft. of water.

The Hastings Telescope.

Professor Charles S. Hastings, of Yale University, New Haven, Conn., has discovered a method of finding practicable combinations of three kinds of glasses to produce objectives without secondary aberration. Some of the results of his new method, as applied in making a telescope of small size, are described by him in a recent number of the *American Journal of Science* as follows:

The largest objective which could be made of the pieces in my possession was of 2¾ inches clear aperture. This, though smaller than desired, was sufficient to give a fairly satisfactory answer to the questions. Accordingly the glasses were worked accurately to the curvatures and thicknesses corresponding to the computations and mounted for use. The astonishing beauty of the images in the new telescope was its most surprising feature at first. The familiar purple was wholly wanting, or, at least, could only be recognized with the closest attention, with magnifying powers greater than forty to the inch aperture and on objects most suitable to its exhibition. But the moment that the instrument was applied to astronomical use it was also evident that its defining power was remarkable. The companions to Polaris and Rigel, instead of being objects which require somewhat careful looking, as is the case with my eye and an ordinary achromatic of the same aperture, were strikingly plain. More difficult, but certainly seen, was the fifth star in ϑ Orionis. The binary star η Orionis was so well elongated that its position angle was estimated to within 5° of its true value. On the other hand, ξ Ursæ Maj., which I suppose to have at present a separation of 1".7, was divided only with difficulty on a fairly good evening, though it was supposed that it would be easy. Saturn showed all that I have seen with an admirable telescope of considerably greater apertures, including more than half of Ball's division, the ring C, a single belt, and five satellites, though Tethys and Dione have not been seen unless they had an elongation equal or greater than that of the end of the ring. Rhea has been seen in conjunction. By reference to the records of many observations which I have made with various telescopes, the power of the new telescope was estimated as equivalent to a 3½ inch objective of the ordinary construction. The powers used varied from 58 to 265 diameters, with 194 as the most satisfactory for Saturn and for double stars.

Another method of determining the relative power of the telescope was by comparing the distances at which a table of logarithms could be read with it and a very perfect telescope of 2⅝ inches aperture made a number of years ago, and with which I have observed a great deal. Allowing for the 5 per cent increase in size in the new instrument, the mean of five tolerably accordant determinations indicated a gain of 23 per cent, or that the new objective was equivalent to a 3⅜ inch objective of the ordinary construction. This ratio of improvement is doubtless higher than would generally be admitted as possible by most opticians, but it must stand for the present as the best value attainable.

[In view of these surprising results, a new era of interest in the science of astronomy seems about to open. Glorious discoveries are likely to follow the application of the new system to large telescopes.—ED.]

A Fast Train.

Mr. Geo. J. Lunn gives the programme of one of the runs of the vestibule trains from Savannah to Jacksonville, on February 7 last, when the distance of 172 miles was done at the average rate of 52·4 miles per hour. Several runs aggregating 60 miles were made at the rate of 60 miles per hour or over, 12 miles at over 70 miles per hour, and one run of five miles was made at 75 miles per hour. This run was made by Savannah, Florida, and Western engine 80, built by the Rhode Island Locomotive Works, Providence, R. I. Cylinders, 18 in. by 24 in.; driving wheels, 72⅝ in. diameter; gauge of track, 4 ft. 9 in.; driving wheel base, 9 ft. 1 in.; fuel, coal; boiler, of steel, 62 in. diameter; number of tubes, 239, 2 in. diameter by 11 ft. long; fire box, 78 in. long, 34 in. wide, 66 in. high; weight on drivers, 71,300 lb.; weight of engine, 105,400 lb.; weight of tender, 76,420 lb.; total weight, 181,820 lb.; is thoroughly equipped with the Westinghouse brake for the whole train, steam brakes on the drivers, weight of the train without the engine being about 340,000 lb., a total, including the engine, of 521,820 lb.

The Chignecto Marine Railway Company.

The company formed to construct this application of the late Captain Eads' plan for passing ships over land by railroad, instead of by canal, issues a prospectus in the London papers of March 18 and 19, from which we learn that Sir John Fowler and Benjamin Baker, with Mr. H. G. C. Ketcham, of Fredericton, are to be the engineers.

The share capital is divided into £300,000 preferred shares and £100,000 common. The preferred shares to have 7 per cent cumulative, after which the common shares are to receive 7 per cent. The Dominion government guarantees an annual subsidy for 20 years, payable half yearly, of $170,602, as long as the capital does not earn 7 per cent, after which excess earnings are to be divided between the government and the share holders. The company is also authorized to issue £700,000 5 per cent bonds.

The railroad, which will be 17 miles long, is expected to save from 300 to 500 miles for vessels that would have passed through the Straits of Canso, and 700 miles for those that would have rounded Cape Breton, and the total sum to be estimated at 2d. per ton on cargo and 6d. per ton on hulls. The directors have contracted with Messrs. John G. Meiggs & Son, contractors in the Argentine Republic and elsewhere, to complete the work for the share and debenture capital; the contractors to pay interest on preferred shares during construction.

Trial Trip of the Ferry Boat Bergen.

The screw ferry boat Bergen, of the Hoboken Land and Improvement Co., which was illustrated and described in the SCIENTIFIC AMERICAN of December 8, 1888, had her trial trip on March 30. It consisted of a run down New York Bay and up the North River. The appearance of the boat, with her long cabins and comparatively unencumbered sweep of deck, is far superior to that of other boats of the side wheel type.

Her engines developed about 900 horse power, distributed as follows: High pressure cylinder, 298 H. P.; intermediate cylinder, 292; low pressure cylinder, 303. This was indicated at 140 lb. boiler pressure throttled down about 20 lb. She made 158–160 revolutions. A measured mile was run with and against the tide, giving an average time for the mile of 4 min. 19½ sec., or a rate of 13·85 miles per hour. The trip was a perfect success in every way, and augurs a successful issue to what is an experiment as yet untried in this vicinity. The marine engineering profession was well represented among the guests invited.

The Paris Exhibition.

[FROM OUR SPECIAL CORRESPONDENT.]

PARIS, March 15.

So far as the principal buildings are concerned, the machinery department will be one of the least decorated in the exhibition. This occurs because of its great size and the fact that it cannot be subdivided by partitions as other departments are, these subdivisions affording excellent scope for decoration. Nevertheless, the machinery department has a good deal of ornamentation and decoration, since both sides of the roof are used for this purpose.

The spaces between the roof girders form panels about 25 or 30 feet deep, which extend up to the glass part of the roof. On one side of the building these panels contain cornucopiæ and the arms of the various towns, departments, etc., in France, the paintings beneath showing their productions. The other side of the roof is similarly decorated, but devoted to foreign countries. Here, for example, is a description of two of these panels:

In the center and at the top, in large letters, is "America," and beneath it, in a raised oval frame or panel, is a portrait of General Washington, beneath which is a shield, on which is painted the United States flag. On each side is a cornucopia filled with fruits, etc. On the right hand side is the word "China," and beneath it a shield having the armorial bearings of the city of Pekin, beneath which is a spray of a tea plant. On the left is "Autriche," with a shield with the armorial bearings of Vienna, and beneath it ornamentation, among which is a spray of hop vine. On the left hand of this, and between the two next roof girders, is a crown, and beneath it "Londres" and the English standard, with cornucopiæ as before. On the right of the crown is Denmark, with the armorial bearings of Copenhagen, beneath which is painted decoration, whose most prominent feature is a horse's head. On the left side is "Italie" and Rome with its shield. The cornucopiæ are raised in zinc, but of course painted.

The English are said to be spreading themselves in the matter of decorations, and here is a description of their section of products of woods and forests. First of all, let me remark that in this section of the exhibition buildings the departments are divided by partitions that do not extend to the roof, so that when you stand at the door and look into a department, not only its own roof but those of neighboring departments are in view. This, from the great taste displayed in the coloring of the roof, gives a very fine *coup d'œil* as one enters. Looking straight down one of these departments, one sees that it is divided off by partitions that do not extend higher than the side partitions, so that the full length of that section of the roof is before the eye. The glass extends down about one-third of the depth of the roof and is painted a very pale blue. Below the glass are two rows of panels, extending from one roof girder to the next and one panel being beneath the other. The stringers of the roof are painted crimson, and the upper panel is of pine stained a deep rich yellow. At the point where the roof glass meets the panels there are suspended and looped up heavy, rich silk cord (crimson and white), with huge tassels to match, and strung upon the cord is ornamental bead work corresponding in color.

The side partitions have a maroon ground, with a dado at the top, the feature of the pattern being yellow and pale green. The partitions between the sections of this department are not completely decorated yet, but here is an idea of one of them. The open archway, through which one passes from section to section, has the letters indicating the character of the section and numbers to identify the section in the catalogue. The decorations on the archway are scarlet edges, white ground, and scroll green leaves gilded on their edges. The cases in this department are so far a plain black.

One of the most striking features of this part of the decorations is the charmingly subdued effect that is obtained, notwithstanding the employment of many positive and striking colors, for there is not a trace of the "Dutch" effect one so dreads where any of the reds and other strong colors are employed.

Some of the iron columns used in the buildings are similar in construction to the rectangular columns of parts of the New York elevated roads, but there is more open space between the ironwork. This space is, however, filled in with fancy tile work, one layer being composed of tiles about 8 inches deep and the next about 2 inches deep. These tiles are not all one plain color, but mottled, as it were, the reds running up or fading off rather into yellows and ochers of various shades.

In some cases, where the natural construction of the building is not considered to afford sufficient scope for ornamentation, a little art is brought into play. Thus I saw an artificial column formed by a square wooden framework, on which at intervals were nailed segments making a round collar on which laths were nailed, thus forming a round column, which will appear as a necessary part of the building, and which when ornamented or decorated will add greatly to the effect.

Some of the machines are, I am informed, to be shown at work at stated times, and this will greatly add to the interest in the exhibition, and enable a much more thorough examination of the merits of the exhibits. American screw-cutting machinery in operation would certainly bring the exhibitor considerable orders. Not that there are not American bolt cutters here, for I have seen them at Elders', on the Clyde, and in other large shops, but they are not generally known, and much inferior machines are in general use. I am of decided opinion that in all branches of thread cutting they are behind here. Not long ago, indeed, a member of one of the largest pipe manufacturing firms of Great Britain came out to New York to inquire into American methods, and in consultation told me that they had been unable to make their pipe threads and fittings taper, and to discover how it was done was the object of his visit. I referred him to some back numbers of the SCIENTIFIC AMERICAN, to a paper read before the American Society of Mechanical Engineers, and to some trade literature got up, I believe, by Mr. M. D. Luehrs, of Cleveland, Ohio, and to whom many of us are under obligations for information on screw-cutting matters. Most of the American bolt cutters I find here are the productions of Wm. Sellers & Co., of Philadelphia, and this undoubtedly arises from the judges' report at the Centennial Exhibition, Wm. Anderson, an eminent English engineer (formerly of the Woolwich Dockyard), being one of the judges.

American sandpapering machines there is undoubtedly a good field for here, especially to some of the ship building yards; and as I have seen the mortising machines of J. A. Fay & Co., of Cincinnati, here, I have been surprised at not finding their sandpapering machines, especially as I have seen as many as ten men sandpapering by hand at one time. Of course it is only a matter of time when such machines will either be imported here or copied.

One thing I am pretty well convinced of already, and that is that you can find a great many more American machines, or copies of them, in either France or England than you can find of foreign machines or copies of them in the United States (some American machines have been more successful here than in the United States); one of the most recent examples in point being the Worthington steam pump, which has become very popular in England since the English government ordered them for the Soudan. It is an open secret now, I believe, that when those pumps were ordered, the Worthingtons tried in vain to persuade the English engineers to have compound condensing pumps, and that it was afterward discovered that in consequence of this advice not having been followed, the pumps themselves would have about consumed all the water the pipes would convey by the time it reached the last pump.

I find a good many firms here using the emery wheels of the Tanite Company, of Stroudsburg, Pa., and machines using them in a novel manner are to be exhibited. I also find wooden wheels, leather covered and coated with very coarse emery, being used where, it seems to me, solid wheels would be better, that is, if a proper cementing material can be found for such very coarse emery when used on such comparatively small wheels as 6 inches diameter.

In the matter of drilling machines, the French and English manufacturers do not approach the American. They do not, indeed, seem to understand the advantages of the American form of construction, such, for example, as the quick return motion of the spindle; and this recalls to my mind the fact that an English engineer of very high standing stated, in his articles on American machines at the Centennial Exhibition at Philadelphia, that he was of opinion that these motions would be short-lived. As a matter of fact, however, the tendency has been and is to widen the range of feed and to provide all machines of any size, or rather all machines having an automatic feed, with a quick return motion. "You Americans," said an English engineer I met in the machinery department, "seem to us to be in a chronic state of change. Why, it is not long ago that I used to read in your papers about the clumsy, heavy English lathes, when all at once you turn about face and put more iron into some of your lathes than we English would ever think of. During the last year or two you have run off into a groove in quick return planing machine beds, shooting them back as if out of a catapult; but just you wait a little while and see, when the rack and pinion teeth get worn, what a nice little thump you'll have every time the table reverses. It's all very well while you have your cut gearing a dead fit, but two or three years will tell the tale."

Now it is quite true that we did suddenly begin to put more iron into the framework of our lathes and planers, but not one jot of their handiness was sacrificed, whereas the English lathes, and the French ones too (so far as I have as yet seen the latter), are the perfection of clumsiness; but as I shall probably go into this part of the subject somewhat in detail in connection with the exhibits, I withhold any further remarks at present, more than to say that while I have seen the English form of lathe, and some of them of English make, in several large shops in the United States, as at R. Hoe's, at the Betts Machine Works, Wilmington, only one firm that I know of consider them superior to the American lathe, and I am pretty sure that time will modify that opinion. While on this subject I cannot refrain from mentioning a piece of botch work I saw in an English shop a short time back. A piece of 4 inch shaft, about 6 feet long, had a keyway chipped in it for about half its length, and the man was trying to save filing by putting it in the lathe and using the slide rest as a traveling tool carrier or ram. He fastened a tool in the required (sideways) position, jammed the shaft tight between the centers, and putting on a feed with the cross feed screw, moved the slide rest along, carrying the cut along the keyway. But the tool cut deepening, he could not move the slide rest, so he first got a man to help him and then he got a piece of tube as a lever to move the slide rest with. A more mechanically murderous piece of work I never saw, and the result was just what I expected, for out came a tooth from the pinion, and a moment after out came another from the rack. If such a thing as that had occurred in an American shop, the man would soon have found the outside of the door; but as it was, they coolly went to another lathe of the same pattern and that was not being used, took out its pinion, put it in place of the broken one, and started on anew with the tube lever, one of them remarking, "Something has got to go. I don't know whether it will be the tool or the pinion." To make matters worse, there was an unused planing machine standing idle in the shop.

JOSHUA ROSE.

Expansion of Timber due to the Absorption of Water.

BY PROF. DE VOLSON WOOD.

It is stated by some writers upon the properties of building materials that timber shrinks but little in the direction of its fibers from being thoroughly dried, or expands but little in the same direction from the absorption of moisture; but the amount of these changes was not given in any work that I examined. Desiring to get some definite knowledge upon this subject, I caused to be prepared some pieces of pine, oak, and chestnut. The pieces selected were from lumber fairly seasoned, and were afterward kept in a dry room for three weeks before any measurements were made. The pieces were straight-grained, free from knots or other defects.

In order to secure accurate measurements brass pins were driven near the edges and ends, opposite to each other, and a fine mark made in each. The measurements were made to the nearest half-hundredth of an inch. The pieces were about five-eighths of an inch thick, thirty-six inches long, and five and one-eighth inches wide.

After the first measurements were made, the pieces were put into a vessel of water and allowed to remain there thirty-seven days, at the end of which time they were measured again. The measurements were made on one side only. The following are the mean of the results:

Specimen.	Pine.	Oak.	Chestnut.
Initial length, inches	35·505	35·572	35·582
Final length, "	35·622	35·602	35·640
Elongation, "	0·017	0·030	0·058
Per cent of elongation	0·05	0·085	0·16
TRANSVERSE MEASUREMENTS.			
Initial width, inches	4·470	4·464	4·481
Final " "	4·586	4·620	4·645
Expansion, "	0·116	0·156	0·164
Per cent of expansion	2·6	3·5	3·6
Rate of lateral expansion / Rate of elongation =	53	41	22½

It will be seen that the chestnut expanded laterally and longitudinally more than the oak or pine, that the rate of longitudinal expansion was about three times that of the pine, and the lateral expansion was about one and four-tenths that of the pine. The expansion in the direction of the fibers was larger than I anticipated, especially in the oak and chestnut.

The Use of the Telephone on Railways.

A novel application of the telephone has been made on the railway between Saint Valerie-sur-Somme and Cayeux (France), with a view to facilitate communication between a train broken down on the line and the nearest station. *Industries* says the stations on this line are already in telephonic communication by means of an overhead wire, and in the guard's van of an experimental train was fitted up a telephone, with battery of ten Leclanche cells and call bell. One pole of the battery is put to earth by being connected to the framework of the guard's van, and the other is joined in the usual way to the telephone, the other terminal of the latter being connected with a wire, by which connection with the existing telephone line can be made at any point. To facilitate this operation the wire is inclosed in a light steel tube, long enough to reach the overhead wire from the roof of the van, and provided at the end with a hook for attachment. Upon ringing up, the stations in front and rear of the train receive the signal, and conversation can be carried on with both simultaneously. The object of this arrangement is to enable the guard of a train, delayed or broken down on the line between two stations, to call for assistance. The apparatus carried in the guard's van is self-contained, inclosed in a box, and weighs only about 25 pounds.

EXPERIMENTS IN MAGNETISM.

BY GEO. M. HOPKINS.

Nature furnishes permanent magnets "ready made," the lodestone being an example of such a magnet. She is able to induce magnetism in magnetic bodies, the

Fig. 1.—MAGNETISM BY INDUCTION FROM THE EARTH.

earth itself being the great magnet by which the induction effects are secured. It is to the directive force of this great magnet that the compass owes its value.

The magnetism of the lodestone is due, doubtless, to a long exposure to the inductive influence of the earth's magnetism. Any body of magnetic material becomes temporarily magnetized to some extent when placed in the magnetic meridian parallel with the dipping needle, and if it be a body like soft iron, without coercive

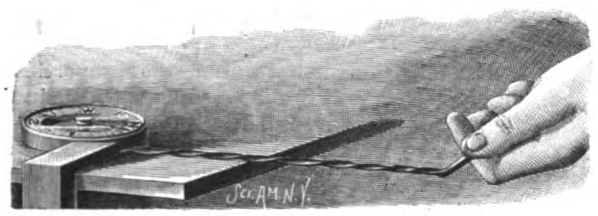


Fig. 2.—DEVELOPMENT OF MAGNETISM BY TORSION.

force, it loses its magnetism when arranged at right angles to this position in the same plane. This may be readily demonstrated by placing a rod of well annealed wrought iron in the magnetic in an inclined position, as indicated in dotted lines in Fig. 1, with its upper end in close proximity to the end of a compass needle. The needle will be instantly deflected, showing that the rod has become magnetic. When turned in the plane of the magnetic meridian to a position at right angles to its former position, it will lose its

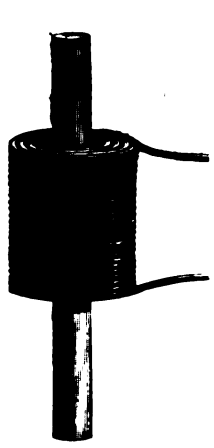


Fig. 3.—MAGNETIZATION OF BARS.

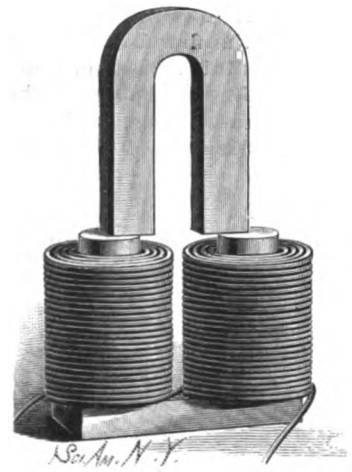


Fig. 4.—MAGNETIZATION OF U-SHAPED BARS.

magnetism and will therefore be no longer able to repel the needle. By placing a bar of hardened steel in the magnetic meridian and striking it several blows on the end with a hammer, it becomes permanently magnetic, not strongly, but sufficiently to exhibit polarity when presented to a magnetic needle.

By twisting a rod of soft iron having one of its ends in proximity to a magnetic needle, it is shown by the deflection of the needle that magnetism is developed by torsion. By this and similar experiments it may be shown that stress and compression favor magnetization.

Artificial magnets are produced by the contact of hardened steel with magnets or by means of the voltaic current. The latter is the more effective method, provided a strong current and a suitable helix or electro-magnet is available. For the magnetization of bars of steel a helix like that shown in Fig. 2 is needed. Its size and the amount of current required will, of course, depend upon the size of the bar to be magnetized. For all bars up to ⅝ inch diameter, a helix ⅝ inch in internal diameter, 2 inches external diameter, and 2½ inches long, made of No. 16 magnet wire, is sufficient. A current from five or six cells plunging bichromate battery is required, or in lieu thereof, a similar current from a dynamo.

The bar to be magnetized is hardened at the ends and placed in the helix, the current is then applied, and the helix is moved from the center of the bar to one end, then to the opposite end and back to the center, when the current is discontinued, and the bar is removed. If several bars are to be magnetized, they may be placed end to end, and passed through the coil in succession. The magnetization of U-shaped bars may be accomplished by means of an electro-magnet formed of two coils above described and a suitable soft iron core. The U-shaped bar is placed on the poles of the electro-magnet as shown, when the current is sent through the coils for a short turn and then interrupted. Another method, which is perhaps more effectual, consists in drawing the U-shaped bar several times across the poles of the electro-magnet.

In the search for perpetual motion, vain efforts have been made to discover a substance which could be interposed between the magnet and its armature, and removed without the expenditure of power, and which would intercept the lines of force, so as to allow the armature to be alternately drawn forward and released, but no such substance has ever been discovered. The lines of force may be intercepted by a plate of soft iron placed between the magnet and its armature, but it requires more power to introduce the plate into the magnetic field, and withdraw it therefrom, than can be recovered from the armature. Fig. 5 illustrates an experiment showing how motion may be produced by the force of a permanent magnet. An armature is suspended by threads in the field of a permanent magnet. The magnet attracts the armature, slightly deflecting its suspension from a true vertical line. The introduction of a soft iron plate between the magnet and its armature intercepts the lines of force, thus releasing the armature, when it swings back under the influence of gravitation. If at this instant the iron plate is withdrawn, the magnet again acts upon the armature, drawing it forward. Another introduction of the iron plate into the field again releases the armature, when it swings back, this time a little farther than before. By moving the iron plate in this manner synchronously with the oscillations of the armature, the armature may be made to swing through a large arc.

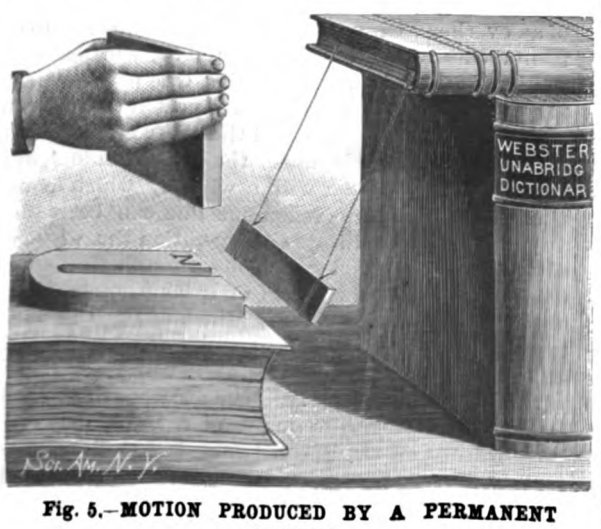


Fig. 5.—MOTION PRODUCED BY A PERMANENT MAGNET.

A Rival to Western Union.

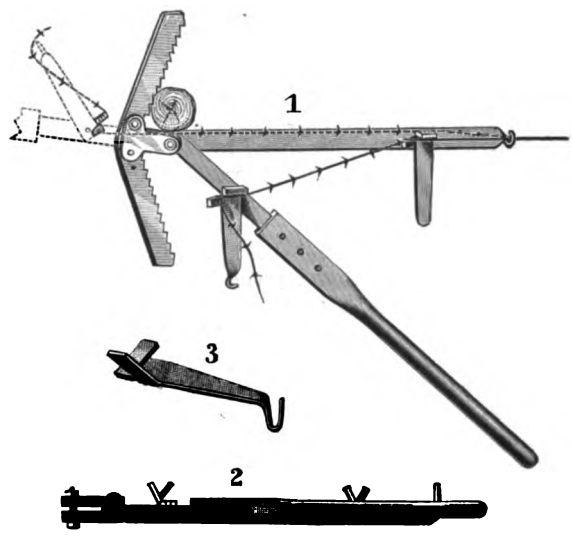
The South Atlantic Telegraph Company, of Baltimore, Md., has been incorporated with a capital stock of $50,000. It is said that the new company is to form a link in the Mackay-Bennett and Postal Telegraph Cable Company system, and is for the purpose of purchasing and owning the lines of that system in Maryland, which are now only leased. The scheme embraces an amalgamation with the Southern Telegraph Company, of Virginia; the Southern Telegraph Company, of North Carolina; and the Southern Atlantic Telegraph Company, whereby lines of wire may be secured extending to New Orleans and covering the entire South and Southwest. This entire system is to be controlled by the Mackay-Bennett management.

IMPROVED STRUCTURE FOR USE AS A SILO.

The construction herewith illustrated is designed to be erected on the surface of the ground for use as a silo. It has been patented by Mr. James E. Rankin, of Elk Rapids, Mich. The preferred size is about sixteen feet square by sixteen feet high, the structure consisting of horizontally arranged and spaced rectangular frames, with vertical linings secured to their inner faces, and a diagonally arranged sheathing attached to the outer face. The inventor styles this structure a straw stack silo, as it may be built with only the inside lining, by using the refuse straw therewith, although a waterproof material may be secured to the diagonal sheathing, with clapboarding outside thereof. The rectangular frames are preferably about nineteen inches apart, sixteen inches wide, and one inch thick, affording large air space between the outer and inner walls, Fig. 2 showing the relative position of the frames and Fig. 3 the manner in which they are joined at the corners by means of an angle bar having its extremities bent in opposite directions to embrace the edges of the approaching sides. There is a door with a three-foot square opening in the center of one side, such door being adapted to be closely sealed, while the roof is supported some three feet above the walls of the structure by means of posts bolted to the frame.

AN IMPROVED WIRE STRETCHER.

A device of simple construction, which may be readily attached to a post and engaged with fence wires it is desired to tighten, the device being one which may be applied with equal convenience to either side of the post, is illustrated herewith and has been patented by Mr. George R. Hughes, of Savoy, Texas. It is of metal, with the exception of an attachable wooden handle, and the body of the device is essentially T-shaped, the members constituting the head being slightly inclined and provided with teeth on their inner face. Fig. 1 is a view of the device in which the dotted lines indicate the relative position of the stretching lever to the other parts after it has been thrown forward to stretch the wire and draw it against the post. On the other end of the main member is a

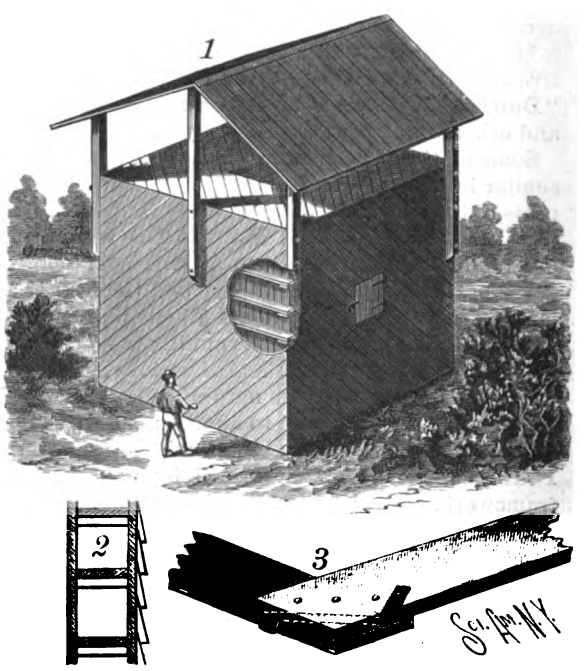


HUGHES' WIRE STRETCHER.

hook or eye through which the wire is first passed, and near it is pivoted a lever with jaws, similar to those shown in Fig. 3, the space between the jaws being just sufficient to receive the wire. Near the head is pivoted a plate with enlarged oval end having apertures in each extremity, adapted to receive a bolt or screw for pivoting the plate to one of the arms of the head, according to the side of the post it is desired to operate upon. The same plate is also pivotally connected to the lever to which the handle is attached, there being also pivoted to this lever a clamping lever having a hook, as shown in Fig. 3. The wire having been passed through the eye and the first clamping lever, the latter is carried around in parallel position to the left, and the jaws of the next clamping lever are engaged with the wire, which is drawn taut, after which the handle lever is carried to the left to the position shown in dotted lines. Great tension is thus obtained, while the wire is firmly held against the post, in position for tacking or making fast in the usual way.

Dangers of Petroleum.

It is remarked by Colonel Majendie that the risk from fire and explosion is not limited to cases in which whole or considerable cargoes of petroleum spirit are shipped. A few barrels, or even one, may suffice. One gallon of petroleum spirit, it has been shown, is enough to render 16,000 gallons of air inflammable, representing a space exceeding 2,000 cubic feet. The penetrating nature of the vapor increases the risk—a fact which has been proved by direct experiment, as well as indicated by actual misfortune. This quality, combined with the high specific gravity and flame-carrying power of the vapor when combined with air, renders its presence highly dangerous, even when the quantity may be small.



RANKIN'S STRUCTURE FOR USE AS A SILO.

AN IMPROVED BOOK SUPPORT.

A stand for supporting dictionaries, large works of reference, etc., and holding them in either closed or open position, has been patented by Mr. James W. Coultas, of Clinton, Ill., and is illustrated herewith.

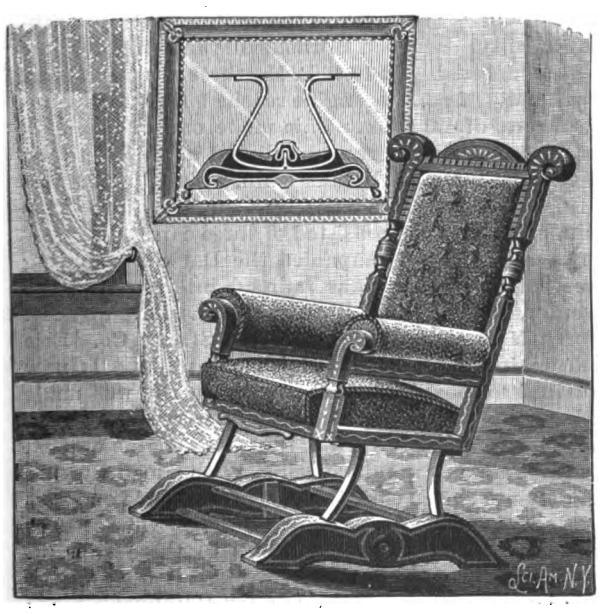
COULTAS' BOOK SUPPORT.

The standard is vertically adjusted, and has at its upper end a serrated disk fitting against and clamped to another disk carrying the book support, in such way that the inclination of the support may be changed to suit the convenience of the user. Between a plate which receives the back of the book and a frame plate are clamped the shank plates of hinges which carry the sides or leaves of the book support, the hinges being adjustable in or out to adapt the book support to receive different thicknesses of books. A spiral spring is arranged parallel and adjacent to the axial line of the two hinged plates, one end of the spring being attached to one plate and the other end of the spring to the other plate, link bars connecting loosely the opposite ends of the spring and the hinged plates, whereby the axis of the spring is thrown away from the axis of the hinge when the latter is opened and the hinge locked in open position. The book, when open, thus rests upon a solid surface, fitted to its back and sides, and is not held open by snaps or hooks.

AN IMPROVED ROCKING CHAIR.

The accompanying illustration represents a rocking chair forming the subject of a patent recently issued to Mr. Lewis C. Gunn, of Seventh and Beach Streets, San Diego, Cal. The base consists of two boxes or casings connected together by cross bars, these casings providing an interior space in which is held the rockers, the several inclosing parts being so finished as to represent a solid piece of wood. The rockers are centrally pivoted on bearings in the sides of the casings, as shown in the sectional view, the shape and size of the interior space being such as to allow free movement of the rockers, the legs of which are so curved as to permit of their free movement in slots extending up through the casing near either end. The rockers are provided with a stop, in the form of a vertical projection extending upward in a central recess of the casing. This projection has a central vertical opening at the top, in which is held a brass wedge, in a groove in the top of which rests a central cushion spring, the spring moving partly through the opening below between the sides of the projections. This spring is a narrow strip of steel, so bent that the sway of the projection backward compresses one side of the spring and opens the other, and *vice versa*, when the projection moves forward.

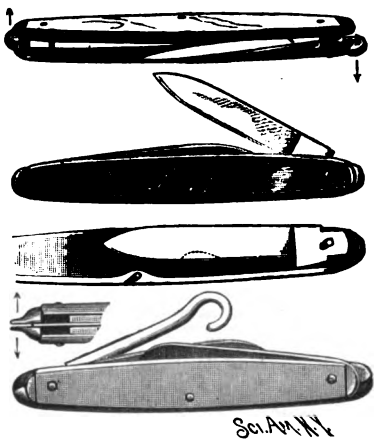
To further aid in giving the rockers an easy and yielding movement, an elastic bearing is located beneath them, consisting of a main spring with a broad fold at each end, there being a fulcrum beneath the fold at each end of the spring, where it is made fast. The length of the spring is thus made to conform to that of the curved rocker by reduction of the fold at each end. There is a strip of rubber or leather underneath the whole length of the rocker, as a sole, preventing sound and wear of the parts in moving over the spring below. It is the design of the inventor to avoid all unnecessary weight in the manufacture of this chair, the rocker being made not to exceed three-fourths of an inch in width, of a malleable casting, with long recesses to be filled by tightly-fitting wooden strips. Each end of the rocker is solid, with a hole drilled from the top to admit of a threaded bolt by which the leg is attached, the latter being of hollow wrought iron pipe.



GUNN'S ROCKING CHAIR.

AN IMPROVED POCKET KNIFE.

A pocket knife so constructed that the blades may be moved into position to be seized by the fingers without the use of the finger nails is illustrated herewith, and forms the subject of two patents issued to Mr. Arthur Wilzin, of No. 207 Center Street, New York City. The knives are not complicated in construction, and their general appearance and the form and action of the spring are very nearly analogous to those of ordinary pocket knives, the illustrations showing both two and four bladed knives. The pivotal portion of the blade has a projection, and a receding part terminating in a point or heel, their relative positions to the pivotal point of the blade being such that the projection and the heel will bear against the blade spring in the back of the knife to hold it slightly open. To hold the blade in closed position, when pressed into the handle, a locking device is provided consisting of a pin mounted on a spring arm, the pin projecting through an opening in one of the end tips. After the blade has been slightly opened by moving the pin laterally, which is done by pressing back the tip, the blade may be seized by the fingers and pulled to fully opened position, when the pin will rest against the side of the pivotal portion of the blade.



WILZIN'S POCKET KNIFE.

AN IMPROVED BINDER.

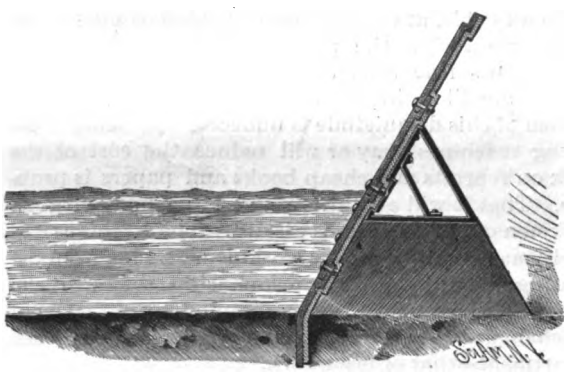
A binder or portfolio in which sheets of a newspaper, pamphlet, etc., may be conveniently bound and quickly removed when desired, and in which a sheet containing an illustration may be extended across the fold in such way that all parts will be visible, is illustrated herewith, and has been patented by Mr. Emil Wansleben. The portfolio has angled brackets attached to its inner face adapted to hold a longitudinal bar in fixed position, from which bar a series of pins is projected. A second detachable bar of equal size is provided with apertures corresponding with the pins, and upon the outer face of this bar springs are held to slide, their movement being limited by studs integral with the bar, projecting through elongated apertures in the springs. One spring is placed between each two apertures in the detachable bar, and a semicircular recess is formed in each extremity of the spring adapted to bear against the pins on the fixed bar when the device is in use. The springs are slightly bowed, and are expanded by sleeves sliding over them upon the detachable bars. The needle employed consists of a strip of wire bent upon itself to form a series of staples corresponding to the number of pins on the fixed bar.

For further information relative to this invention address Mr. Henry Rohr, St. John, Kansas.

MR. JOSEPH M. GRIGGS, general ticket agent of the Boston and Albany for about 24 years past, has resigned, and is succeeded by his son, George B. Griggs, who has been in the service for several years. The retiring general ticket agent has been in the service of the Boston and Albany and its predecessor, the Western Railroad, for 47 years, having begun in 1842. He was for a long time cashier of the road, and before that was local ticket agent.

IMPROVED PROTECTOR FOR DIKES OR LEVEES.

A removable shield or protector, which may be placed at points of danger in dikes or levees in times of high water, in order to prevent disaster, is illustrated herewith, and has been patented by Messrs. James M.

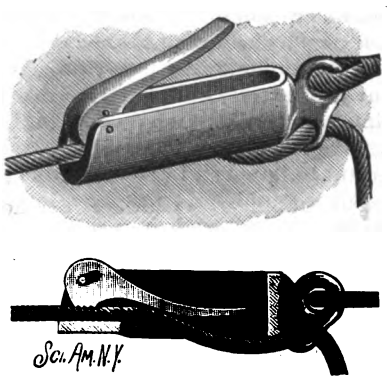


McLEMORE & JONES' LEVEE PROTECTOR.

McLemore and Charles D. Jones, of Coushatta, La. The shield is made in sections of cast or wrought iron, bolted together, each of the sections being formed with a rabbet, on which the overlapping section fits to make a smooth front and a water tight joint. This shield is applied to and extends below the water front of the levee, as shown in the sectional view, where four of these sections are used. The shield is backed by the front wall of the levee, but extends above the crown of the latter, where it is strengthened by braces firmly bolted or otherwise anchored. This shield can be used upon either old or new levees, and when used in new constructions allows a much smaller quantity of material to be employed than ordinarily.

AN IMPROVED ROPE CLAMP.

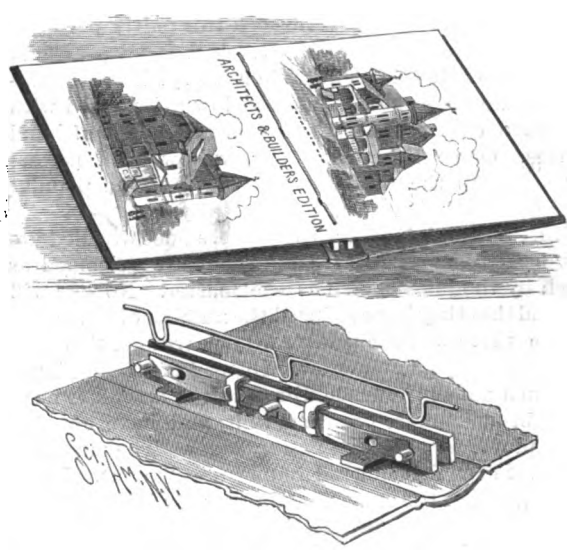
A simple form of clamp, especially adapted for use on clothes lines, tent ropes, etc., is shown herewith. It has been patented by Mr. S. William Conklin, of Yonkers, N. Y.



CONKLIN'S ROPE CLAMP.

The frame of the clamp is preferably made of malleable cast iron, in one end of which is pivoted a clamping lever, formed with an eccentric notched upon its lower surface to engage the rope. The clamping lever has an inclined slot for its pivotal pin, so that any strain upon the rope will tend to draw the lever forward and force it downward upon the rope, thus increasing its holding action. The opposite end piece is formed with a ring by which the clamp is secured to one end of a rope, and also a lower ring through which the opposite end of the rope is passed after being drawn through the open space back of the clamping lever.

IN a recent lecture at the Society of Arts on the Forth Bridge, Mr. B. Baker described a practical method he had adopted for the purpose of determining the effective area of the bridge exposed to a wind pressure striking the work at different angles. A model of the bridge was made and towed in water at different angles to the stream; the area of a flat board normal to the current was then determined, which exerted the same drag as the model. This area was then taken as the effective area of the bridge for the particular angle at which it was towed.



WANSLEBEN'S BINDER.

Do Machines Hurt a Trade?

BY THEODORE L. DE VINNE.

There seems to be an uneasy feeling among compositors about type-setting machines. It is true that only three of the many recently invented are at practical work, but all of them give a promise of usefulness, if not in all fields, at least in some field of composition. It is certain that the machines have come to stay. Compositors fear that they will reduce the price of labor, and will indirectly drive them out of business.

Much of this disquietude is unnecessary. That type-setting machines may or will reduce the cost of the work on reprints and cheap books and papers is probable. That it will ever drive any large body of good workmen out of business is absurd. The machines will surely make more work for workmen. So far from decreasing the standard of workmanship, they will elevate it. This conclusion is warranted by a review of the changes in the trade made by inventions in another department—that of presswork.

Fifty years ago the advantages of machinery in presswork were recognized in this country, but they were not fairly tried. Stereotype, composition rollers, cylinder presses, and Adams presses had then been invented, but were little used. The New York *Sun* and New York *Herald* were trying to print growing editions of their then petty sheets on hand presses. Harper & Bros. and other book printers in New York were doing their presswork on hand presses. Books were cheap and editions were small; pressmen were abundant and wages were low. Journeymen piece compositors were paid an average of twenty-four cents per thousand ems, and earned seven dollars a week with difficulty. Weekly wages for time compositors were nine dollars, but this sum was earned only by the more active and expert. The average wages of piece compositors, and occasional time hands was not over seven dollars a week. Hand pressmen, paid almost entirely by the piece, had to do an amount of hard labor to earn nine dollars a week which the modern power pressmen would regard as excessive and unreasonable.

Although work was hard and wages small, there was even then a dislike to machinery—a dislike which seems to have been imported from abroad. Johnson, an eminent printer of London, had already denounced the printing machine, then in use in London, as the destroyer of the living of pressmen, and called upon Parliament to impose a tax on machine presswork, so that machines could not work for a lower price than hand presses. In 1830, and even as late as 1848, the journeymen printers of Paris destroyed printing machines in the Royal Printing Office of that city as well as in other offices, because they said that these machines were taking the bread out of their mouths. Stereotyping, invented by Ged in the last century, had been delayed more than fifty years by the opposition of hand pressmen, who secretly battered plates in the supposed interest of compositors. Master printers were afraid to use the new process. Composition rollers were opposed by pressmen, because they enabled a boy to do the work of the extra man, who wielded the old-fashioned inking balls. The first inking machine attachment was found more objectionable, because it enabled the master printer to dispense with this extra roller boy or this extra man who had been regarded as necessary to the working of the hand press. Every invention or process that increased production was regarded by working men as an evil agency.

In this country there has never been any active hostility to new machinery in the printing business. There have been no mobs or strikes against inventions, but workmen look on all new devices with suspicion and unfriendliness. They do not see that the invention which temporarily throws one man out of work ultimately makes work for two or more men.

What would have been the state of the trade if we had no stereotype or electrotype, no composition rollers, and no printing machines? The daily newspaper, as we now have it, would be an impossibility. An edition of two thousand or twenty-five hundred copies of a small sheet would be the highest performance of the hand press, and what severe work this paltry performance would impose on the wretched hand pressman who had to print this edition in a hurry! The illustrated magazine of large edition and low price, filled with fine wood cuts, could not exist at all in days of hand presses. One could go on and show how hand presses would curtail the production not only of the popular but of the artistic forms of typography.

Processes and machines that were once dreaded are now used by every printer, and they are welcomed as much by the journeymen as the master. No one will pretend that they have reduced the number of workmen. Where there was one printer fifty years ago, there are at least twenty printers now. Instead of driving hand pressmen out of the trade, the printing machines have really brought more pressmen in it, and have enabled an employer to pay them better wages. The machines have not even driven good hand pressmen out. In all our large cities the expert hand pressman is in active demand. He does but one-half the labor of his predecessor, yet he is paid twice as much and has steadier work. For some forms of printing the hand press is more economical than any machine, and if there were more men who could use them skillfully, they would be more generally employed. They are not used because it is difficult for an employer to get a boy to learn this branch of presswork. He objects, because the work is hard. Not even for double or treble the old pay will a pressman in 1889 undertake to do on a hand press the work done by all pressmen in 1840.

The journeyman book compositor of New York, who works by the piece, now earns an advance of seventy-five per cent on the rates of fifty years ago. The time hand gets twice as much. Expert machine pressmen in the larger New York book offices are paid $20 and $22 a week—an advance of more than one hundred per cent. If they are specially skillful or active, they are cheerfully paid a good deal more. They have steady employment and comparatively easy work. It should be noted that the highest wages are always paid in those offices that have the most and best machinery. Low wages are the rule almost without exception in all offices that have little or no machinery. Instead of throwing men out of work, machinery has made a demand for more work. Instead of lowering the price of labor, machinery has raised it.

It will be noticed that the prices of composition have not increased as much as those of presswork. The compositor's advance is seventy-five per cent or less; the pressman's is one hundred per cent or more. The reason is plain. Composition has not as yet received any appreciable benefit from type-setting machinery. Nearly all of our composition is done by hand, as it was done fifty years ago, but the piece compositor who works in an office that has many printing machines earns more than he does in an office that has few machines. Indirectly he obtains advantages from machinery, which he personally does not manage.

As a rule, the average piece compositor is a better educated man than the average pressman. Under equal conditions he should and would earn higher wages, but his superior intelligence and education do not increase his production. This production is limited by the slowness of his hands, which is now as it was fifty years ago. If the compositor was employed on a type-setting machine, he would get some of the benefits of the increased production. With more machines there would necessarily be more composition; there would be more compositors, and they would be better paid.

One reason why the modern pressman is better paid than the old pressman is because he is a better workman. The machine is more complex than the hand press, and it compels the pressman to exercise more forethought and intelligence. He has to keep it in order and to get a fixed quantity of work from it within a limited time. To accomplish this he does not have the hard stretching of the muscles that was called for by the hand press, but he does have to do twice as much work with his brains. It is this work of the brains more than that of the hands that earns him higher wages, but it is the machine that spurs him up to this increased mental activity.

As a rule, the mechanics who most bitterly decry machines are those who have been found incompetent to handle them. The men who refuse to learn the theory or the practice of new processes—who are content to do work as it was done when they were boys—who "don't want to be bothered" by the study of new problems in handicraft—who evade or shirk responsibilities—are the very men that employers don't want to employ upon their machines. That they may and probably will suffer for their persistent refusal to adapt themselves to changed conditions is much to be regretted; but are they blameless? Is it the fault of the master, or the machine, or the workman himself?

It is probable that many employers will at first try to get composition done on machines with the cheapest labor. Many of them will employ poor workmen, inexpert boys and girls. They will sophisticate themselves with the notion that a cheaply paid helper will soon be taught to do as much as an expert workman. This is the error that was made when power presses were first introduced. There were employers who reasoned, "It is the machine and not the man that does the work. The machine is the first consideration and the man the second, a cheap man can be made to do as much work as a high priced man." This fallacy is no longer believed. Every master printer who does good presswork, or even tries to do a large amount of of presswork in a given time, regardless of quality, knows that an expert workman at high wages is always more economical than the cheap workman. He takes better care of the machine, he gets more work out of it. The same conclusion will be reached after a long trial of type-setting machines. The expert man who thoroughly understands his business will always be in demand. He never need to fear the competition of boys, or girls, or amateurs.

It is really amusing to reflect on the cheerful short-sighted stupidity of the earnest trade union men, who so violently opposed all improvements in typography. Really meaning to benefit the trade, they were actually doing their best to destroy it. If they had carried their point, if they had suppressed all labor-saving devices, if they had kept the trade in the same narrow rut it was in fifty years ago—what would be the present condition of most of the men who are now earning fair wages in pleasant situations in our trade? It is plain that if these improvements had been prevented, they would not be in the trade at all. There would be no place for them. The limited amount of work that could be done on hand presses would have kept them out. They would have been obliged to find employment in other fields. Most of them would have had to do hard manual labor, or accept inferior situations in which they could with difficulty earn nine dollars a week. In view of the enormous blunder then made by sincere men, a thinking compositor may now well question the wisdom of the policy that oppresses type-setting machines. — *National Publisher and Printer.*

New Barometer Scale.

BY JAMES ASHER.

Instead of saying the air supports a certain height of mercury, I state the ratio of given pressure to standard. I say pressure is 1,000 thousandths of normal in place of saying it sustains a thread of mercury 760 mm. high. The point 760 in barometers will be marked 1,000; divisions 0·76, usual length.

ADVANTAGES.

1. Scale tells fraction of normal pressure in decimals.

2. Divisions are shorter, hence greater accuracy with integers.

3. Using it with my milligrade thermometer scale (see SCIENTIFIC AMERICAN, Nov. 26, 1887), we can correct bulks of gas to normal pressure and temperature with elegant simplicity. In correcting to standard temperature, 1,000 is numerator and temperature denominator; and to standard pressure, 1,000 is denominator and pressure numerator: 1,000 cancels. Hence the brief

RULE.—Multiply by pressure and divide by temperature.

Ex.—Barometer shows 983 thousandths, thermometer 1,065° milligrade; what will 648 c. c. of gas be at normal?

Solution: $\frac{983 \times 648}{1065} = 598{\cdot}1$ c. c.

4. With equal ease we find weight of bulk, given pressure, and temperature.

Ex.—A gramme of H at standard fills 11·19 liters; what will 43 liters weigh, barometer 1,018, thermometer 954° M?

Solution: $\frac{1018 \times 43}{954 \times 11{\cdot}19} = 4{\cdot}08$ grammes.

Problems need a third of usual time.

5. Aneroid and sympiesometer in graduations will be independent of mercurial barometer.

[The above is an excellent suggestion and well in line with the milligrade thermometer scale. The present barometric scale is so awkward that Prof. Bunsen, in his gas analysis calculations, reduces all volumes in his formulæ to a pressure of 1,000 millimeters.—ED.]

Remarkable Runs by the Strong Locomotive.

In our issue of January 12 of the present year, we gave an illustrated description of the Strong locomotive A. G. Darwin. At that time the engine was doing express service on a New England road, which was not a fit place for the development of the locomotive's capacities. In order to test these to the uttermost, two trial runs were made upon the New York, Lake Erie, and Western Railroad, between this city and Buffalo. On April 1, at 9:24 A. M., the engine left Jersey City with six cars. Other cars were picked up *en route*, so that at one time nine cars were attached. Over part of the route a speed of 65 miles an hour was maintained with this heavy load. Several delays occurred, one near Callicoon, where a derailed train was in the way, and another of equal duration at Hornellsville. These delays the engine made up without difficulty. Between Hornellsville and Buffalo snow was encountered. At 10:27 P. M., three minutes ahead of schedule time, the engine reached Buffalo, an unbroken run of 423 miles. This made one of the most remarkable runs on record, eclipsed as to length by the famous Jarrett & Palmer train, which, in 1878, was taken to Pittsburg, 444 miles, by a single engine. This train, however, only consisted of three cars.

A special party accompanied the Darwin, including representatives of various railroad interests, and the inventor, Mr. George F. Strong. It was driven by Mr. George McRae, an engineer of the Strong Co. Erie R.R. engineers accompanied him as pilots. It now remained to show that this remarkable run was made without undue effort; accordingly, in a snow storm, on the morning of April 2, the same engine started from Buffalo on the return trip. With a load varying from nine to eleven cars, the return was made on exact schedule time, the train reaching Jersey City at 10:55 P. M. A special interest attaches to these runs, in view of the fact that the road traversed is of about the same length as the famous London-Edinburgh roads on which the fast running occurred last summer.

PHOTOGRAPHIC NOTES.

Adhesives for Mounting Purposes.—Many photographers use nothing but rather thin glue, which, however, should be made from a material free from any elements of putrescent fermentation, and not acid. The glue sold as French medal glue is generally clear, not in a state of incipient decomposition, and free from acidity. Half a pound in a quart of water is a convenient strength. Milk may be used instead of water, and is said to keep the glue from becoming brittle. An addition of sugar—say one-fourth of the weight of the glue—is perhaps more effective. The use of glycerine is open to objection. The following preparation is useful for gumming large sheets of paper, which may be kept on hand ready for use; when wetted they will stick well on glass: Starch two drachms, white sugar one ounce, gum arabic two drachms, to be boiled with a sufficient quantity of water. The same mixture can be used in making adhesive mounts upon which moist prints will adhere by pressure only.—*Photo. News.*

Mounting Prints.—There are three systems by which prints may be mounted, all of them possessing advantages peculiar to themselves.

That in general use is the time-honored one of applying paste by means of a brush to the back of a wet pile of prints placed one on top of the other as a matter of convenience, and then deftly transferring each print thus treated from the top of the pile to the mount, upon which it is laid down in position and pressed into contact by a pad or rubber. No special precaution or care is requisite in carrying this system into effect beyond seeing that the paste is free from hard particles and is freshly prepared. Glue or gelatine, which is employed by some as a mountant in preference to starch or paste, requires more dexterity in its employment.

A second system, introduced about sixteen years ago, consists in sizing the mounts with any suitable adhesive of the gum or dextrine class, these being kept in a state of preparation always ready for use. The print requires no pasting or other treatment, but may be taken while simply in a wet or moist state and laid down in its place on the dry mount, followed by the rubbing requisite for insuring contact. This system is very convenient in many cases, especially for one who desires the occasional mounting of a few prints without having to experience the trouble of preparing paste and going through the whole operations consequent upon the act. We are glad to know that mounts ready gummed are now commercially procurable. Those who desire to prepare mounts for themselves must be careful in selecting a gum of a suitable nature. It may be applied by a sponge or large flat brush, although preferably so by a little machine for the purpose, introduced by a Halifax firm, and exhibited at some of our societies a few years ago.

The third system is one which is adopted much more extensively in America than in this country, and is highly suitable when large quantities of prints are to be mounted. As witnessed in operation in the States six years ago, when many thousands of prints were undergoing this process, we specially noticed its neatness, the rapidity of its action, and the impossibility of producing cockling. The backs of the prints are coated with ordinary starch paste and allowed to dry. The prints are then trimmed and laid *in sit* on the paper (or card) mounts to which they are thenceforth to be permanently attached, which mounts, however, have first been rendered slightly damp. A number of prints thus prepared are then run through the rolling press, and the operation is complete.

Arrival of Great Steamship.

The new and magnificent ocean steamer City of Paris arrived at this port on the 11th inst., on her first trip, having made the voyage from Queenstown in the remarkably quick time of 7 days, 11 hours, 39 minutes. It is believed her speed will be increased after a few more voyages have been made and her machinery becomes a little worn. As it was, the vessel made 498 miles as her fastest single day's run. The Paris is a younger sister to the City of New York, which was finished, and made her first voyage last season. Both ships are substantially similar in size, construction, and machinery.

Length over all, 580 ft.; length on water line, 525 ft.; breadth, extreme, 63¼ ft.; and depth, moulded, 42 ft.; the gross registered tonnage being 10,500 tons. The vessels have very fine and graceful lines, and their beautiful appearance is in nowise impaired by the clipper bows with which they are provided. Each ship is propelled by two sets of triple expansion engines, and they are supplied with twin screws, so that if one engine or propeller should become disabled, they can proceed with the aid of the other. This provision has already been found of great value.

THE *Electrician* reports a rumor from Berlin to the effect that a means has been discovered of using electricity for ascertaining the true north, instead of the magnetic needle; that, in short, the new means will be superior to the compass and is likely to supersede it.

Correspondence.

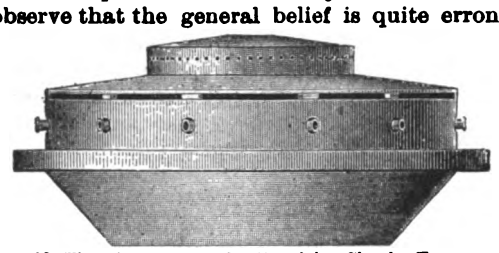
The First Inventor of the Monitor Turret.

To the Editor of the Scientific American:

Paragraphs substantially the same as the one published under the above head line in your issue of April 6, p. 216, have appeared at intervals since January, 1863. Had you not expressed your approval of assertions made by a correspondent of the Washington *Star*, who "rightly says" that "Theodore R. Timby is the real inventor of the monitor revolving turret," and that large royalties were paid "for the use of his invention," indicating that even you entertain a mistaken notion, no notice, just as in the recent past, would have been taken of the erroneous statements.

The following extract from one of Captain Ericsson's contributions to historical literature, bearing on Mr. Timby's claim to priority of invention, is instructive:

"The most important object, namely, the rotating turret, will now be considered; but before describing this essential part of the Monitor system, it will be well to observe that the general belief is quite erroneous



Side Elevation of a Floating Revolving Circular Tower, Published by Abraham Bloodgood in 1807.

that a revolving platform, open or covered, is a novel design. So far from that being the case, this obvious device dates back to the first introduction of artillery. Sixty-four years ago the writer was taught by an instructor in fortification and gunnery that under certain conditions a position assailable from all sides should be defended by placing the guns on a turntable. Long before building the Monitor I regarded the employment of a revolving structure to operate guns on board ships as a device familiar to all well informed naval artillerists. But although constructors of revolving circular gun platforms for naval purposes, open or covered, have a right to employ this ancient device, it will be demonstrated further on that the turret of the monitors is a distinct mechanical combination differing from previous inventions. The correctness of the assumption that revolving batteries for manipulating guns on board floating structures had been constructed nearly a century ago will be seen by the following reference to printed publications.

"The *Nautical Chronicle* for 1805 contains an account of a 'movable turning impregnable battery, invented by a Mr. Gillespie, a native of Scotland, who completed the model of a movable impregnable castle or battery, impervious to shot or bombs, provided with a cannon and carriage calculated to take a sure aim at any object.' It is further stated that 'the invention proposed will be found equally serviceable in floating batteries. Its machinery is adapted to turn the most ponderous mortars with the greatest ease, according to the position of the enemy.' Again, the transactions of the Society for the Promotion of Useful Arts in the State of New York, 1807, contains an illustration representing a side elevation of a circular revolving floating battery constructed by Abraham Bloodgood.

"The guns of this battery, as the inventor points out, 'would be more easily worked than is common, as they would not require any lateral movement.' It is also stated, as a peculiar feature of this floating battery, that 'its rotary motion would bring all its cannon to bear successively, as fast as they could be loaded, on objects in any direction;' and that 'its circular form would cause every shot that might strike it, not near the center, to glance.' Thirty-five years after the publication of the illustration and description of the circular floating revolving tower of Abraham Bloodgood, Theodore R. Timby proposed to build a tower on land for coast defense, to be composed of iron, with several floors and tiers of guns, the tower to turn on a series of friction rollers under its base. The principal feature of Timby's 'invention' was that of arranging the guns radially within the tower, and firing each gun at the instant of its coming in line with the object aimed at during the rotary motion of the tower, precisely as invented by Bloodgood."

It is interesting to learn that Mr. Timby got his idea of a revolving tower from seeing the land defense on Governor's Island, and, perhaps, it will interest your readers to be informed that Captain Ericsson's conception of what became the Monitor was during a visit at Portsmouth (1828), when being rowed past the "wooden walls" which were regarded as England's bulwarks, he remarked to his companion, Count Adolf E. Von Rosen: "It has just occurred to me how all these stately ships could be at the mercy or destroyed by a single opponent," and got the curt response: "Then, for God's sake, keep it to yourself if you want to succeed in England." This mind image was never lost sight of; it was simply held in abeyance for opportune development.

The statement that $5,000 was paid to Mr. Timby "for the use of his invention in the construction of that vessel" (the Monitor), "and a like sum for each turret constructed . . . in building of the other ironclads for the government," is erroneous.

The Monitor engaged the Merrimac March 9, 1862. Previous to the issue of the first patent to Timby (dated July 8, 1862, the last being dated September 30, 1862) Mr. John A. Griswold and others made a discretionary agreement with him by which they could purchase at a stipulated price his patents for the United States, should he obtain any. Having in view their important contracts, they felt bound to protect themselves against any delay in the completion of the monitors, then greatly needed by the government, should legal complications arise. October 6, three patents were assigned to Mr. Griswold, and Mr. Timby was ultimately paid $15,000.

Captain Ericsson frequently had occasion to refer to this transaction, and maintained that the principal object of the preliminary arrangement to secure the Timby patents was to enable Mr. Griswold and others (not including himself) to control the erection of revolving forts on the coast of the United States, and that his (Captain Ericsson's) strong opposition to the scheme and its failure, attributed to his interference, was the cause of a somewhat unpleasant feeling between himself and one of the associates in the Monitor undertakings, and he emphatically denied that Timby's patent claims in any manner affected the principal or detail of the monitor system, and that Timby did not receive to the amount of one cent royalty on account of the original Monitor, nor on the monitors that immediately followed.

Now fifty-six turrets were built by the different contractors, hence, according to the Washington *Star* correspondent, Mr. Timby received the handsome sum of $280,000 for his embryo!

The numerous communications on this subject received by Captain Ericsson and the claims of a host of inventors made him somewhat callous. He was, however, once much amused by the extraordinary demand of a colored man for compensation, because he had, he said, suggested the Monitor, both turret and hull, by the peculiar manner he folded a table napkin when waiting upon Captain Ericsson, at a dinner in the old Moffat House restaurant.

S. W. TAYLOR, Private Secretary.

New York, April 6, 1889.

Harvey F. Gaskill.

It is with profound regret we learn of Mr. Gaskill's decease, at Lockport, N. Y., on the 8th inst., at the age of 44 years. Mr. Gaskill was a distinguished engineer and inventor, the active head of the Holly Manufacturing Co., and the real author of the well known Holly water works system.

Among the thirty or more patents secured by Mr. Gaskill, and which are of indispensable value to the Holly Manufacturing Company, are the Gaskill horizontal and the perpendicular engines, the Gaskill triple compound pumping engine, a number of water meters, conceded to be the best in use, steam pump, pump valves, engine valves, motion water motors, Gaskill hydrants, etc. The Lockport *Daily Union* says: "When it is taken into consideration that one single individual is the inventor of a set of water works and pumping machinery that beyond the power of contradiction excel all other inventions in this or any other country, it is wonderful, and in the demise of Mr. Gaskill not only Lockport, but the world at large, has lost one of its greatest benefactors. Untold millions of property have already been saved by this superior class of pumping machinery, and its value is all the time increasing, as new works are being completed in all parts of the country."

Electrical and Industrial Exhibition at Birmingham.

An electrical and industrial exhibition is to be held in Birmingham during the months of August, September, and October. A very large amount of support has been promised for it, and there is every prospect that it will prove a success. The electrical department will be divided into three sections, the first including all kinds of machinery and apparatus for electric lighting, the second relating to complete displays of electric lighting on various systems, and the third comprising telegraphs, telephones, phonographs, electric bells and clocks, electric welding and smelting, electrotyping, telpherage, and miscellaneous apparatus. The industrial section will consist largely of Birmingham manufactures and manufacturing processes, although it will include many other subjects.

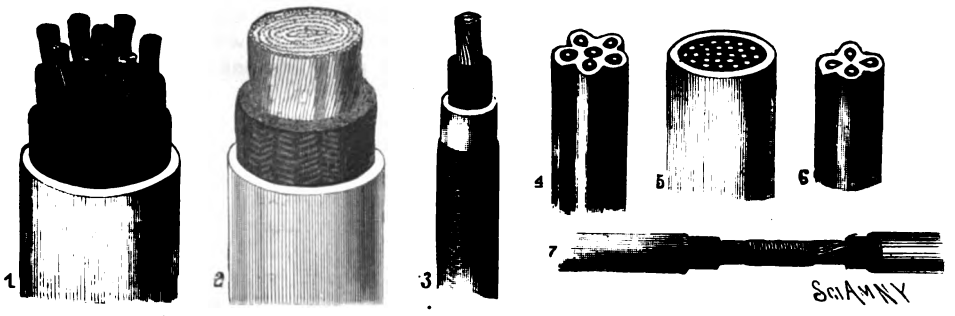
Estimated Amount of Fire Hose Pipe Now in Use in the United States.

Cotton	2,766,250
Rubber	1,777,000
Leather	346,650
Linen	259,550
Unclassified	469,750
Total feet of fire hose in service	5,619,200

THE ELECTRIC SUBWAYS OF THE CITY OF NEW YORK.

(*Continued from first page.*)

vided with a double lid. The lower lid is held down in place by a gun-metal cross-bar and screw, and is provided with a tubular India rubber gasket, which is held in a groove and never leaves the lid. (See Figs. 2 and 3.) This gasket bears against a lip on the curb, so that when the lid is in place and the fastenings screwed, the hole is almost or quite hermetically closed. Above this inner lid comes the second lid, which is loose, and which lies flush with the pavement of the street. These manholes are placed about 250 feet distant from each other. They average one for each street block.



1. Eight-lead arc light cable. 2. Incandescent light cable. 3. Single-lead arc light cable. 4 and 6. Fire department cables. 5. Telegraph cable. 7. Splice in arc light cable.

Fig. 4.—DIFFERENT FORMS OF SUBWAY CABLES.

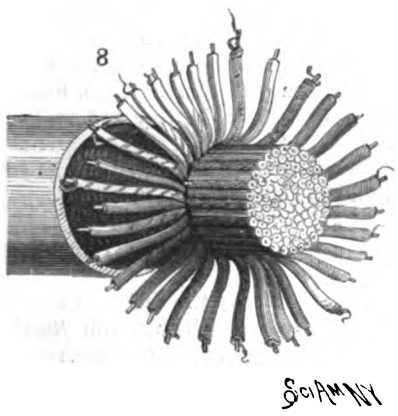
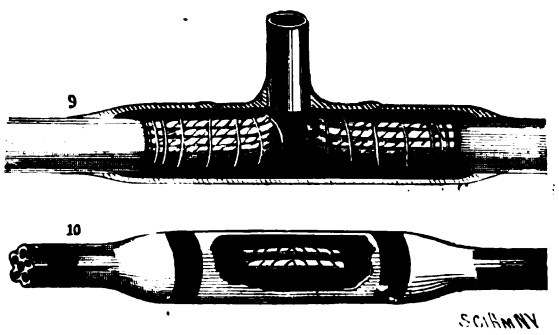


Fig. 5.—TELEPHONE CABLE OPENED FOR SPLICING.



9. Branch connection with cable. 10. Splice in cable.

Fig. 6.

From manhole to manhole a number of pipes are carried, 2½ to 3 inches in diameter. These pipes are generally of wrought iron of the type of gas or steam pipe. They are asphalted inside and out, or coated with some equivalent protective material. On each end they are threaded, forming slightly tapering screws. They are connected by means of sockets as usual in steam or gas fitting, and are screwed up powerfully, so as to bring metal against metal, forming the most perfect joint that can be made in this class of pipe. When in place they are embedded in concrete. Thus, taking the system as a whole, we find at every block a manhole, the iron or brick lined excavation already described, and connecting the manholes are a number of wrought iron pipes embedded in concrete. As a matter of nomenclature, the pipes are called ducts; the system of pipes and the concrete in which they are embedded is termed a conduit; and the whole system of ducts, conduits, and manholes together is termed an electric subway.

The method of laying the concrete conduits may now be given. Its direction is first determined, and the pavement is removed over the line; a trench is then excavated in the street to a depth which may vary from 3 ft. to 5 ft. The bottom of the trench is first leveled to the determined grade. This, of course, is subject to wide variation, because the streets are at present so occupied with gas mains and water pipes that very wide departures from what would be the normal level have to be made to meet these exigences. The bottom of the trench is then well rammed, and planks are laid against the side, in order to prevent it from caving in. A layer of concrete is put in place and rammed home. On this is placed a horizontal series or row of the iron pipes, which in turn are covered with a second bed of concrete. A second row of pipes is placed upon the new concrete base, and they are covered with a third bed of concrete. Any number of pipes may thus be embedded. A typical subway would give a breadth of five lines of pipe and a height of four layers, but the system lends itself to any number.

When the cement, which is the best American cement that can be procured, has set, so that the concrete is hard, the whole forms a homogeneous monolithic mass. The concrete on the bottom, sides, and top of the subway is far thicker than between the pipes, so as to form a better protection. Above the concrete, 2 inch yellow pine planks are laid, which have been creosoted with from 12 to 16 pounds per cubic foot. This is designed to protect the structure from injury by pickaxes or crowbars in the hands of workmen excavating for any purpose. When it is considered that the pipes used are lap-weledd, and can withstand an internal pressure of 500 pounds to the square inch, and, naturally, a very much higher external pressure, the great strength of the conduit will be apparent at a glance.

The conduits being laid and manholes built, completing the subway, the next problem is to introduce the cables into the ducts. These cables vary greatly in size and arrangement of wires, and we illustrate a number of sections in the cuts, Figs. 4 and 5.

In Fig. 4 the general type will be seen to comprise the conductors surrounded with insulating and wrapping material incased in a pipe of lead or of lead and tin alloy. The arc light cable contains sometimes eight leads. The incandescent cable is of very large capacity, consisting of a multiple wire conductor insulated and protected with the lead coating. The Fire Department cables are fluted in outline, and one rib is pointed or angular on one shoulder. This gives a means of identifying the leads; calling the one under the angular rib No. 1, the others in regular order are designated as No. 2, 3, etc. The method of splicing arc light cables is also shown in the cut No. 7 and in Fig. 9. The ends are brought together and lapped and wound with wire, and solder is applied to secure the most perfect electrical contact. A telephone cable is shown in Fig. 5. It contains wires that are individually insulated only. Different colored wires are used to facilitate identification. These admit of easy separation for splicing purposes or for making side connections. The Metropolitan Telephone Co. generally uses a cable containing the wires arranged in pairs and each pair twisted. The ultimate use of these is for metallic circuits, the twisting tending to diminish induction.

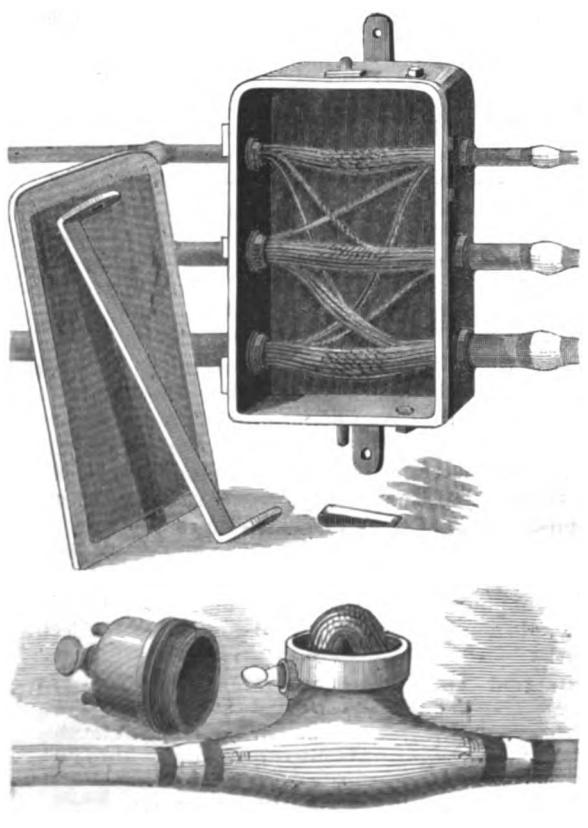


Fig. 7.—DISTRIBUTION BOXES FOR USE IN MANHOLES.

The cables have now to be drawn into the conduits. This operation is illustrated in Figs. 1, 2, and 3. The workmen are supplied with a number of rods of wood, each about 3 feet long, and tipped with brass male and female screws at the ends. Entering a manhole, the workman pushes one of these into a duct into which a cable is to be introduced. He screws another rod to it, and pushes it about 3 feet farther, or its own length, screws another rod to that, pushes it in, and so on until a line of rods screwed together reaches through the conduit to the next manhole, perhaps 250 feet distant. These rods are shown in Figs. 1 and 3. A small line is attached then to the last rod introduced, and a workman at the further manhole withdraws the rods, unscrewing them as they come out, until he gets the end of the small line. To this a strong rope is attached, which is drawn through. The end of the cable is fitted with an iron loop screwed fast to it. Brass bushings are placed within the end of the duct, provided with shoulders to prevent their being drawn into it. These prevent the sharp edge of the iron pipe from marring the metal coating of the cable. The rope is now fastened to the loop, attached to the cable, the end of the cable is passed down into the manhole, and made to enter the duct through the bushing, and the rope is drawn through from the other end, the cable following it. Of course, great power is required to do this, on account of the stiffness of the cable, and we illustrate in Fig. 3 the form of capstan used in drawing the cable into the duct. It will be seen that the power of four or more men may be required in turning the drum. Where care has not been exercised in laying the pipe, burrs may exist at the couplings. These materially increase the friction where they exist. The ends of the pipes should be smooth internally, and any projecting metal should be removed by filing or reaming. As a general rule, the cable is cut in pieces, so that a single length is enough to reach from manhole to manhole, with an allowance for splicing. In many cases the cable is of double length, when it is fed into the manhole, both to right and left, its loop or bight gradually disappearing into the manhole, and being gradually straightened out in the operation. It is often necessary to use a blower, to expel gas and bad air while work is going on. This plan is adopted when a manhole contains so much gas as to render work in it difficult. It is seen in Fig. 1.

The ends of the lengths of cable thus introduced have now to be joined. To do this, they are opened, the wires for a few inches are stripped of their insulation, and connected. The joints thus made are wrapped, in the case of telephone or telegraph cables for each individual wire, with insulating tape, and a lead sleeve previously passed over the cable is slid over the joint. Wiped joints are now used to secure the whole, so that the joint is as strong and water-tight as any other part of the cable. The operation is shown in Fig. 9.

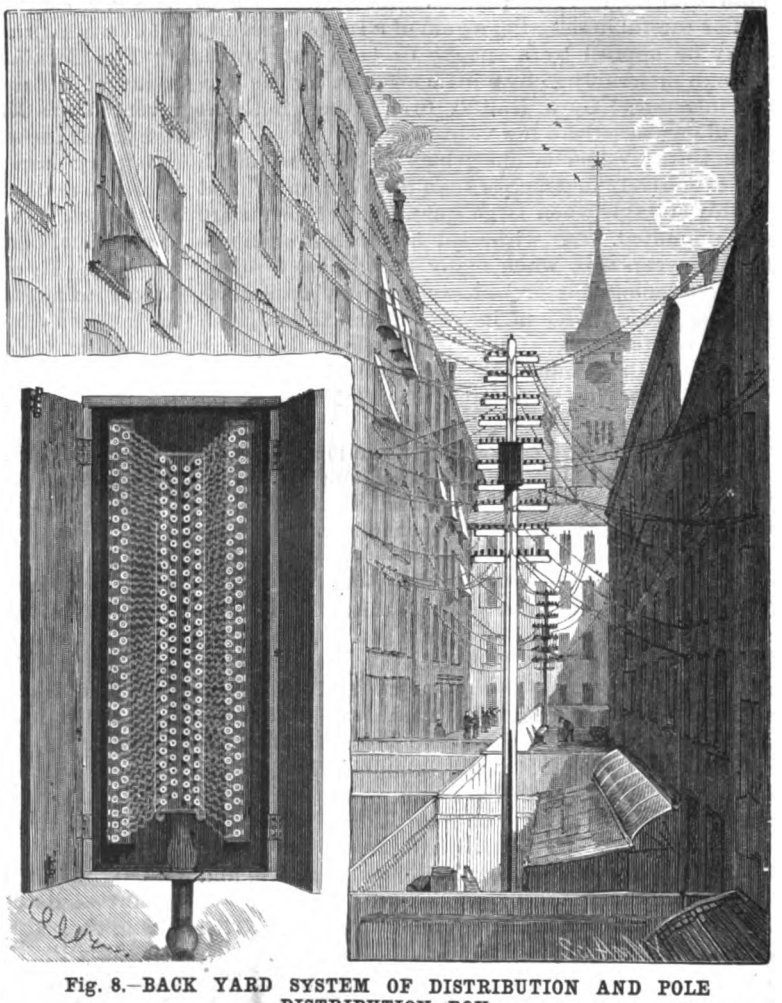


Fig. 8.—BACK YARD SYSTEM OF DISTRIBUTION AND POLE DISTRIBUTION BOX.

This provides for transit lines. It will be seen from the cuts, Figs. 6 and 7, how the cables lend themselves to lateral leads. The cable can be opened and any desired wire picked out for side connections. For use in the manholes, distributing boxes, shown in Fig. 7, are provided, which allow perfect freedom for the with-

drawing and distributing of specific wires from the manhole as a center. Hand-holes, shown at bottom of Fig. 7, are used for distribution from a single cable only. The transit ducts included in the conduits, as described, are supplemented by external lines of pipe, laid above the creosoted plank work, directly in the earth, which are termed distributing ducts. These are to provide for local service, and at intervals they have hand-holes, which are hollow castings similar to the lower box in Fig. 7, giving access to the wires, to which castings pipes are connected leading into the separate buildings or to the different lamp posts. These last named pipes are termed service pipes.

For private house distribution, the house top or back yard system is adopted. For the first named as many leads of cable or wire as requisite are taken out of the manhole and carried up the front wall of a building to its roof and thence distributed where needed. The back yard system, shown in the cut, Fig. 8, involves the erection within the block of a single distributing pole. The cable is brought to it from the manhole, preferably by an underground and cellar route, and carried up to a distribution box shown in the same cut. Entering this box the cable is opened and its wires distributed and carried to the cross arms of the pole and thence to the houses requiring the service.

The kinds of current to be provided for resolve themselves into two—high and low tension. The low tension represents telephone and telegraph service; the high tension, the electric power and light leads. When it is necessary to have both kinds of current in the same street, two main conduits are laid, one for each type of service, and they are placed on opposite sides of the street. Furthermore, the rules of the Board of Electrical Control do not permit the use of wires in the same cable which differ in potential from each other more than 500 volts.

Other forms of subway are in use. The Dorset conduit,* made entirely of asphalt concrete without iron ducts, was one of the earliest forms laid. This presents the peculiarity of insulating the cable covering. The regular conduit grounds it, through all that lies within the ducts. The Johnstone subway, seen in Figs. 1 and 2, made of sectional iron castings for conduits and manholes, has also been used, and is approved of by the commissioners. It grounds the cable coverings. Wooden pipes have also been used in the concrete ducts instead of iron ones. On account of the recent gas explosions the manholes will probably be ventilated, so as to permit any accumulation of gas to escape into the air through a pipe reaching well above the street attached to an electric light pole.

These conduits have been laid by a construction company, as the Board of Electrical Control and their predecessors have had no authority to spend money for such purposes. The construction company, for its return on the investment and general expenses, relies on the revenue received for the use of these ducts. The rental has been based on the use of a single duct per annum and per mile. It will be clear that as each duct can carry six electric light wires, when each wire is in a separate lead-covered cable, and that when the wires are in a single cable eight wires can be contained in a 2½ inch duct, a fairly remunerative rental will not be extravagant. As regards telephone service connection, the cable introduced containing some fifty double wires arranged to provide for through metallic circuits, it follows that on a ground system 100 telephone wires can be provided for by a single duct. The entrance of the telephone cables from the subway ducts into the central station building in Cortlandt Street is shown in the SCIENTIFIC AMERICAN of March 30, 1889.

To give an idea of the extent of work, the figures from the report of the Board for the past year may be quoted:

* See SCIENTIFIC AMERICAN, October 9, 1886.

240,155 feet of trench have been excavated, giving 2,287,880 feet of single duct transit and distributing and central station connections. Allowing 80 wires to the duct, this gives a capacity for telephone and

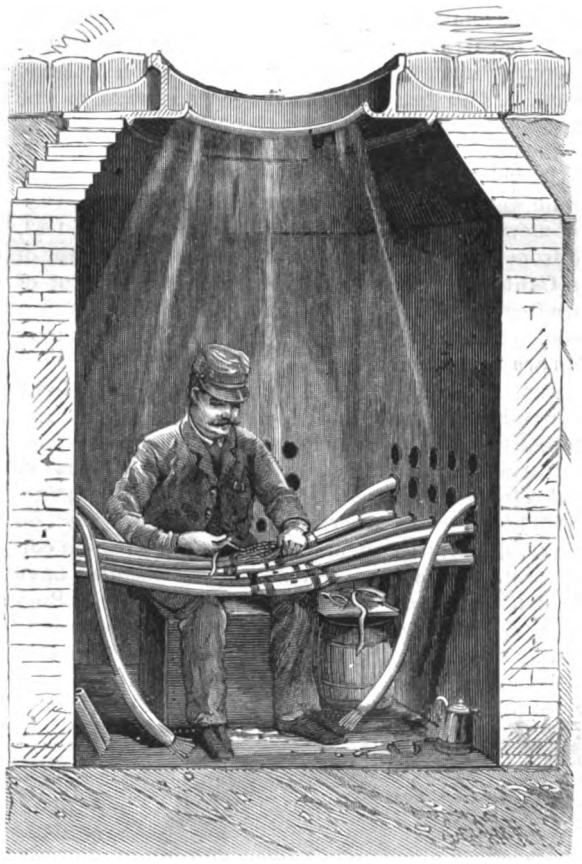
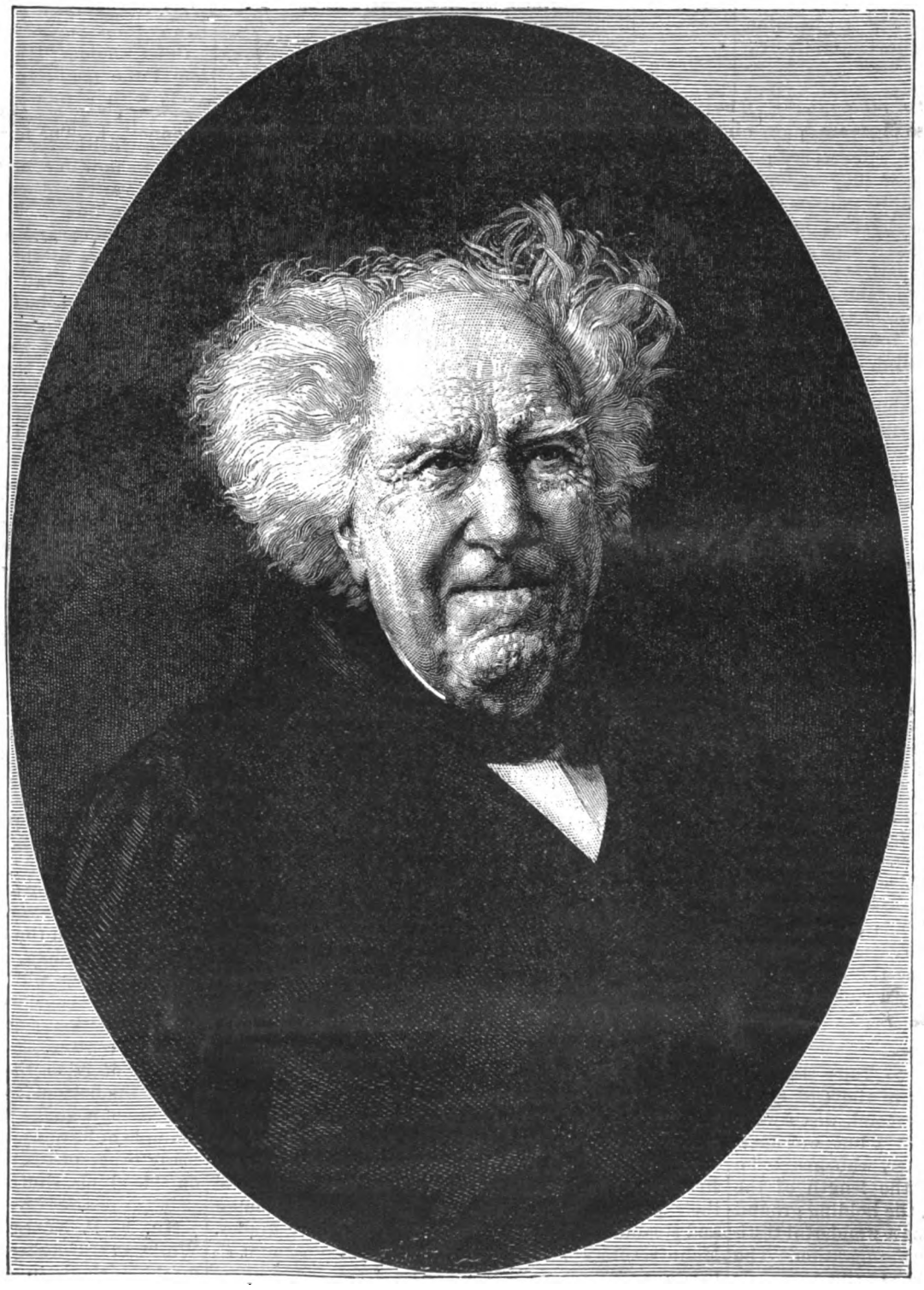


Fig. 9.—SPLICING WIRES AND CONNECTING CABLES.

telegraph service of nearly 35,000 miles of wire, long enough to go nearly one and a half times round the earth. For lighting and power service, 316,796 feet of single duct, with a capacity of 600 miles of wire, had been laid by the end of 1888. The Edison incandescent conduit is separate, and represented 338,376 feet, with over a million feet of conductors.



MICHEL EUGENE CHEVREUL.

MICHEL EUGENE CHEVREUL.

This distinguished French chemist died in Paris on Tuesday, April 9, at the great age of 102 years 7 months and 9 days. His strength had been failing for some months, but his friends had not been without hope that he would live till the 31st of August next, to celebrate the completion of his 103d year. His son, Henri Chevreul, died a few weeks ago, 70 years of age.

The date and place of M. Chevreul's birth are well authenticated. He was born at No. 11 Deux Haies Street, Angers, an old city of France, at 8 o'clock in the evening of August 31, 1786, the record bearing the attestation of many witnesses. The parents were both persons of some distinction, the father being a physician and a professor, and living to the age of 91 years. The mother died at 93 years of age. M. Chevreul's memory of his early life was also remarkable, and he used to relate having been the witness of the guillotining of two persons in 1793, when he was but seven years old.

M. Chevreul studied at a central school in Angers from the age of 12 to 17 years, thence going to Paris, where, in 1797, he was admitted to Vaquelin's laboratory, taking his place among several students who were afterward to win a high place as chemists. At the same time Chevreul was giving instruction in another college, and four years afterward became preparator at the Museum. At the age of 30 he was appointed director of the dyeworks and special professor of chemistry at the Gobelins. In 1814 he demonstrated that oils and fats were formed of a mixture of several peculiar principles, including margarine, oleine, and stearine, the latter furnishing stearic acid, and giving rise to the industry of making stearine candles. M. Chevreul's further labors upon fatty bodies and saponification aided also in creating other new industries, besides much enlarging the field of organic chemistry.

In 1842 M. Chevreul assumed charge of the dyeing operations at the Gobelins and Beauvais establishments belonging to the government, and his researches and valuable discoveries touching colors have been almost continuous from that time to this. He has shown that the harmonies of colors are submitted to immutable laws, which may be demonstrated by calculation. His laboratory was a vast room surrounded by show cases, in which were kept specimens of his work, and numerous parcels sent him by various industries, with closets containing various specimens of coloring matters, test tubes, graduates, glass rods, balances, etc. It is not too much to say that there was but little work of much importance, during the past half century, touching the dyeing industries, which his researches did not cover in the extraction, fixation, and observation of colors.

He was examiner for many years at the Polytechnic School, and had always been president of the National Agricultural Society. Up to 1855 he had been a member of the jury of every French exhibition. A member of the Legion of Honor, commander in 1844, grand officer in 1865, grand cross in 1875, he has had all the grades that any scientist could be covetous of. The foreign decorations that he received would cover his entire breast. But honors never elated the indefatigable worker, who was ever studying, and remained more than ever, at the age of over one hundred, the dean of the students of France and of the entire world. The life of the centenarian was passed between the Museum of Natural History, the Gobelins, and the Institute of France. He never failed to be present at the Monday sessions of the Academy. The number of memoirs that he presented to his colleagues is almost incredible. He was never desirous of being a politician, but during the Franco-Prussian war (1870–71), at the age of eighty-six, he willingly endured the pri-

vations of the siege, and did not leave the confines of Paris. He lived at the Museum while more than eighty Prussian bombs were shattering the glasses and breaking the cases.

Of his works several have been translated into English, German, and other languages. The best known are: "Lectures on Chemistry Applied to Dyeing" (2 vols., 1828–31); "On the Law of the Simultaneous Contrast of Colors and the Distribution of Colored Objects Considered in Relation to Painting" (1839), accompanied by a splendid atlas; "On Colors and Their Applications to the Industrial Arts by Means of Chromatic Circles" (1864); and a "History of Chemical Research," begun in 1856. He also wrote on sanitary subjects, on organic analysis (1824), on the optical effects of silken textures (1848), on the divining rod and table tipping (1854), on scientific method (1855), and on the prescription of drugs in medicine (1865). He wrote all the articles on chemistry in the "Dictionnaire des Sciences Naturelles," and edited with comments the "Photographic Researches" of Niepce de St. Victor (1855). It was at his suggestion the practice of charring the interior of water casks was adopted.

M. Chevreul is reported to have left a large fortune. He was tall of stature and well formed, having a vigorous and healthy constitution, which, under his methodical way of life, although he was always an energetic worker, preserved him for a vigorous and healthy activity throughout all his long years.

The Tiffany Exhibit of American Jewel Minerals.

Tiffany & Co., of this city, have prepared an exhibit of minerals to accompany their collection of jewel and art work to the Paris Exposition. It is designed to cover the field of American jewel minerals only, and the endeavor has been to keep it as compact as possible by only including remarkable and unique specimens. Among the specimens of native gold is some of John Marshall's "find" of 1849 at Souter's Mill, the first gold found in California. Native silver is shown in some very beautiful specimens, in one associated with native copper. The last is of special interest, it having been pronounced fraudulent by some English authorities, although really authentic. The first sapphire found in the United States, from Jenks mine, Franklin, Macon Co., N. C., and the first sapphire ever found in its matrix are included.

Beryls, blue, green, and colorless, are shown, including a cut specimen (aquamarine) of 133 karats, from Stoneham, Maine, and emerald crystals from 1 to 8¾ oz. weight. The latter are of greater value as crystals than could be anticipated from them if they were cut. Garnets are present in perfection. Ruby garnets from Fort Defiance, Arizona, and Navaho Reservation, New Mexico; the first samples of cut spessarite garnet, and the great 14 lb. crystal with all faces perfect—a slightly distorted or elongated dodecahedron—and a two inch garnet cup are typical of the character of this mineral as shown. Red, green, and colorless tourmalines from Maine localities are extremely beautiful, and are both cut and in natural crystals.

A number of very beautiful associated malachite and azurite specimens are shown, embodying Ruskin's idea of the green of the earth and the blue of the heavens. It would be hard to find in all mineralogy a more exquisite combination of colors.

Among the quartz minerals are a quantity of crystals, curious on account of their minute size and perfection, there being 7,500 to the ounce.

Crystals of amethysts, smoky and rose quartz and rock crystal, and quartz, jasper, and other arrowheads, some unique, are included. Some of the rose quartz is cut into cups, spheres, and other shapes, and a mass of rock crystal is considered one of the finest shown. An interesting exhibit is olivene from meteorites, two being cut into jewels (chrysolite), forming gems of true celestial origin. An Oregon opal is the first found in the United States. A superb block of amber is shown which is dichroitic or fluorescent, and a massive piece of jet is near it, both illustrating organic jewel material. Pearls from different sources are included; some from Indian mounds, others from the clam, common oyster, and other mollusks. Mottled and black obsidian and the first samples of pectolite and wollastonite ever cut are of interest. The exhibit, which is in part a loan collection, is in charge of Mr. Geo. F. Kunz, who is to accompany it to Paris. By the time this reaches our readers it will probably be on its way across the ocean.

Cure for Roaring.

It may interest owners of horses to know that the mare ridden by Colonel Edwards in the Old Berks Hunt Club race, and who finished second, was a very bad roarer (hence her name "Aroara"), but was operated upon by Mr. Jones, of Leicester, who inserted a tracheotomy tube. Considering the length of the course, a long four miles, the pace, the holding ground and big fences, her performance was a wonderful testimony to the efficiency of Mr. Jones' operation. The tube which is inserted in the trachea of the throat is certainly a wonderful thing. The time occupied in the race was nineteen minutes.—*Land and Water.*

THE REV. J. G. WOOD.

The Rev. John George Wood, who did more to popularize the study of natural history than any writer of the present age, was the son of a surgeon who was at one time chemical lecturer at the Middlesex Hospital. He was born in London in 1827, and was educated at Ashbourne grammar school and at Merton College, Oxford. After being attached for two years to the Anatomical Museum at Christ Church, Oxford, he was ordained in 1852 as chaplain to the Boatmen's Floating Chapel. This post he held for four years, and in 1856 he was appointed assistant chaplain to St. Bartholomew's Hospital. This post he resigned in 1862, and from 1868 to 1876 he held the post of Precentor of the Canterbury Diocesan Church Union. Want of space forbids us to mention more than a few of Mr. Wood's numerous works on natural history. Among them are "Common Objects of the Seashore," "Homes without Hands," "The Natural History of Man," "Our Garden Friends and Foes," and his larger "Natural History," in three volumes, enriched by excellent illustrations from animal painters of the highest rank. He also for some time edited the *Boy's Own Magazine.* In 1879 he projected a series of "Sketch Lectures" on zoology, illustrating them himself by drawings in colored pastels on a large canvas. These lectures have been delivered in all the principal institutes of England and Scotland. His last lecture—on ants—was given in London only a few days before his death, which took place on March 3, at Coventry, from an attack of peritonitis. Sad to say, despite his energy and

THE REV. J. G. WOOD, NATURALIST.
Born 1827. Died March 3, 1889.

industry, Mr. Wood was unable to make any provision for his family, and he has left a widow in very ill health, with six children, absolutely destitute. Donations on their behalf will be received by the Rev. Alfred Whitehead, Vicar of St. Peter's, Kent, and Rural Dean of Westbere.—*The Graphic.*

Curious Facts as to Wheels.

The product of the cycle manufacturers for 1889 exhibits little departure in types of bicycles, tricycles, and safeties, but a number of quite noticeable improvements in details, in the direction of strength and lightness, simplicity, and ease of use. As usual, the old New England makers have the lead in the finer machines.

The cycling industry is still comparatively young on both sides of the metropolis. It began at Hartford about eleven years ago, and took root in other places two or three years later. From the first the New England bicycles were built for men's use, first class mechanically and first class in price.

Whether it is impossible or inconsistent to make both high and low grades of bicycles in the same factory, or whether there is some other local or trade reason for it, the fact is the costlier and finer grades never appear from the same factory with the cheaper and inferior grades.

It may be worth observing, in connection with the fact that the high grade bicycles continue to be made by the two or three leading makers of the East, that there is a difference in the average grades of workmen, often quite apparent. Talent and skill are not only cumulative in the same factory by years of practice, but also go somewhat from generation to generation. Skill, ingenuity, and steady industry, which contribute so much to the productive power represented on any pay roll, are found at a higher average in our older manufacturing centers. Articles and machinery of accuracy or delicacy, or complexity or difficulty of construction, like bicycles, guns, and watches, require in their production just this sort of superskilled labor and steadiness of force, especially in the finer grades. Manufacturers of experience take this into account in locating.

The difference in grade and construction of machines made has no necessary relation to the character of machines that are used in the different sections. The sale of fine grades in all sections is very large and increasing. While the East may not lose its excellence or prestige in cycle making, it is quite likely that the West will gain, until its marks may be as good as a Boston, Hartford, or Chicopee Falls mark. It took Birmingham some time to equal Sheffield, and then some time longer to overcome the "Brumagem" reputation; but it got there, and, as every one knows, is now a center for really fine manufactures.

Of course not all that is made in the East in this line is best, since wherever a successful business is founded imitators spring up; but generally speaking in design of machines, in material used, in workmanship and finish, in substantial improvements over last year's productions, in all that goes to make up the best bicycle, tricycle, or safety, the old New England makers still hold the lead.

The Tobin Bronze.

The Tobin bronze is a metal recently placed on the market by the Ansonia Brass and Copper Company, of 19 and 21 Cliff Street, New York. It possesses many remarkable characteristics. Among its leading qualities are great torsional and tensile strength, with corresponding high elastic limits, as will be observed in the recorded tests by N. O. Olson, Esq., engineer of the department of tests for Fairbanks & Co.

Source		Ansonia Brass and Copper Company.		
Material		Hot rolled Tobin bronze.		
Mark		1	2	3
Test No.		6,491	6,492	6,493
Shape, original, 1 in. round bars.				
Dimensions. Final. Original.	Length, inches	8 in.	8 in.	8 in.
	Diameter, inches	0·645	0 641	0·645
	Area, square inches	0·327	0·323	0·327
	Length, inches	9·36	9·30	9·12
	Diameter, inches	0·518	0·500	0·509
	Area, square inches	0·211	0·198	0·204
	Per cent elongation	17·00	16·25	14·00
	" reduction	35·47	38·70	37·61
Stress in lb. Tension. On Spec.	Elastic limit	17,000	18,000	18,000
	Maximum	26,060	25,720	25,850
Per sq. in.	Elastic limit	51,990	55,730	55,050
	Maximum	79,700	79,630	78,900
	Fracture	Very good.		

Mr. Olson says it is far superior in point of strength to any bronze or metal of that kind he has ever tested.

Chief Engineer Hine, U. S. Navy, after making tests, found the metal to withstand the action of certain acids with a loss that was infinitesimal. It can be forged into bolts with great facility, and is used in large quantities for this purpose in several of the naval steamers now in course of construction for the navy, and for various other purposes, such as dye house and sugar machinery. It has been used successfully for cylinder linings and pump rods by some of the leading pump makers of the country. Owing to its non-corrosibility and high torsional elastic limit, which is equal to that of the toughest grade of machinery steel made in this country, it is being generally used for steam launch and yacht propeller shafting. Another important feature is that it can be drop-forged in the same manner as steel, making it essentially valuable where strong and intricate bronze pieces are required that cannot be obtained by casting. It has been carefully tested, and found to withstand the action of sea water in such a manner as to commend it to favorable notice for sheathing ships and spiles. The ingot metal is adapted for railroad car journal boxes and bearings of all kinds, for land and marine machinery, and, in point of endurance and anti-frictional properties, has given results equal to the best in use.

The company's pamphlet, just issued, contains testimonials from many of the leading firms of the country.

Hanging Doors and Blinds.

In hanging a number of doors which are of the same size, the time expended upon measuring the correct position of the hinges may be, according to the *California Architect and Builders' News,* saved in a very simple manner, which is as follows: Take a lath and mark upon the top and bottom the exact position where the hinges should come, drive in at these marks sharp-pointed brads, and you have a gauge which may be used in hanging all doors of the same size. In using it, all that is necessary is to place it against the edge of the door with the top of the lath on the level with the top of the door, give it a sharp tap of the hand, when the brads will mark the exact position of the hinges. The same gauge lath may be used in marking out the position of the hinges of the stile of the door frame, excepting that a nail should be driven in the bottom of it, so that there may be sufficient room left at the bottom to allow proper play of the door. The use of a gauge lath in the case referred to is an example of its use. It is of equal utility in hanging many other pieces, such, for instance, as inside and outside blinds, shutters, etc.

MR. H. P. ALLIS, the head of the Reliance Iron Work at Milwaukee, one of the largest foundries and machine shops in the country, died very suddenly April 1. He was a man of cultivated tastes, a liberal patron of the arts, and had amassed a large fortune.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM BOILER. — Samuel P. Hedges, Greenport, N. Y. Combined with opposing series of horizontally non-aligning manifolds or headers are inclined concentric tubes connecting the corresponding manifolds of each series, with other novel features designed to secure perfect circulation, and whereby a single tube or section of tubes may be readily removed and replaced, and the tubes be conveniently cleaned.

PRESSURE REGULATOR. — Charles Dubois, Leadville, Col. The valve casing is provided with inlet and outlet apertures, and a hollow piston valve having a spiral port extends through its walls, a spring being arranged to bear upon the piston valve, and a valve-operating cap connected with the valve spindle, making a simple and efficient valve for regulating the pressure of steam or air.

STUFFING BOX.—William E. Brockett, Berlin, Wis. This invention covers a novel construction and arrangement of parts whereby the packing prevents the escape of steam along the piston rod or stem, while the casing is mounted yieldingly upon a spring or springs to permit a vibrating motion of the stem or rod, thus preventing the breaking or bending of the stem or parts of the stuffing box.

Electrical.

REGULATING ELECTRIC CURRENTS.—Joseph W. Balet, New York City. This invention provides a method of regulating the current in dynamo and motor circuits by which any surplus will be sent into storage batteries for use as needed, and to control the charging of the secondary batteries, so that the charging current shall cease in a particular battery when the maximum charge is reached and be returned to the battery when it is discharged.

Railway Appliances.

LOCOMOTIVE AXLE BOX.—Ransford T. Chase, Houston, Texas. Combined with a pedestal is an axle box mounted to slide vertically therein, a second axle box being mounted with one side in a bearing in the pedestal, and a connecting rod secured to the latter axle box and pivotally connected with the first named axle box, whereby the centers of the axles will always remain the same distance apart.

RAILROAD SNOW PLOW.—Charles A. McCarthy and John P. Moran, Sault de Ste. Marie, Mich. The body of the plow is made similar to a box car, and has a vertical wedge-shaped mould board at its front end, in combination with vertically rotating snow wheels on the two faces of the mould board, and smaller vertically rotating snow wheels in front of and above the lower wheels, the mechanism being driven by an independent engine, and designed to throw the snow a great distance from the track.

CAR COUPLING. — Isaac L. Whiddon and Julian S. Bashaw, Chipley, Fla. The drawheads are made with overlapping portions, and have laterally sliding and rotary catches mounted therein, with springs for holding the catches in engagement, and other novel features, the object being to provide a coupling which will couple automatically, and which may be uncoupled from either side of a car.

CAR COUPLING.—Wiley M. Grisham, Winchester, Ill. In this coupling the drawhead has a way for the coupling hook formed with an incline, up which to direct the hook, with a transverse horizontal opening for the coupling pin, the latter having a flange or wing arranged in the closed position of the pin to form an extension or continuation of the incline for the coupling hook, the coupling pin having a rack operated by a toothed wheel.

RAIL TIE AND FASTENING. — Jacob Frysinger, Milan, Ill. This tie consists of upper and lower plate-like bars and an intermediate edgewise disposed plate-like bar let into grooves or channels of the upper and lower bars, the chairs consisting of clamp plates resting upon the upper bar and held in place by bolts passing through the upper and lower bars.

CAR SEAT.—Edward B. Goelet, Fort Worth, Texas. This is a car seat of simple construction, wherein the parts are so arranged that the back of the seat may be adjusted to almost any angle desired, while the seat is also provided with a leg or foot rest adapted to be adjusted to the convenience of the occupant of the seat.

CAR DOOR.—Edward B. Goelet, Fort Worth, Texas. This is a sliding door for use on the side of a car, there being at each side of the door opening vertical posts, and a rail or track below and above the opening on which the door is supported by hangers, the tracks having an inclined surface and extending outwardly in a horizontal line with the car, in such way that when the door is opened it is carried a distance outward from the car, and when closed it comes quickly and conveniently to place.

Agricultural.

CORN PLOW. — William Quillen and Francis A. Dake, Almena, Kansas. This is a machine designed to cultivate both sides of a row of corn or other plants at one passage, and is made with upwardly arched end frames, longitudinal side bars, standards with runners at their lower ends, longitudinal guard frames and shovels, with other novel features, the plow being designed to run steadily and stay in the ground, cleaning out all weeds and grass in the row, and loosening up the dirt close to the corn.

HARROW FOR LAND ROLLERS.—James W. Weir, Princeton, Ind. This is a device for harrowing adapted to be attached to land rollers of ordinary construction, being readily attachable to the front of the rollers, and designed to pulverize the larger particles of dirt clods, that the roller may more effectually do its work, a lever permitting the driver to lift the harrow out of operative position as desired.

Mechanical.

CUTTER HEAD. — Henry L. Haskell, Ludington, Mich. In this device the knife holder has a flanged base and a head with a transverse knife-receiving slot, a threaded aperture extending up through the base and head into the knife slot, and enlarged at its lower end, the invention relating especially to the knives and manner of securing them to the cutter heads of moulding machines.

ORE CRUSHER. — Jacob Rodermond, New York City. In a suitable receptacle, to which the ore to be crushed is fed, is journaled a vertical shaft with bifurcated upper end, crushing rollers with independent axles being pivoted in the bifurcated shaft end, while opposing horizontal arms carrying adjustable shovels to follow the rollers are secured to the shaft between the rollers, the apparatus being designed as an improvement upon the Chilean mill.

RICE HULLER.—Henry Scholfield, New York City. This machine has a tubular sectional body with vertical angular grooves, combined with a rotary hub and a series of flexible and spaced rubbers, each section being secured in an arc of a circle to the hub, with guide plates between each set of rubbers, whereby the hull will be completely removed from the grain, and each grain will be rubbed or scoured.

MIDDLINGS PURIFIER. — George W. Bell, River Falls, Wis. This machine is designed to purify middlings or flour by means of currents of air, and the invention covers novel features of construction and arrangement of parts whereby all the finer and heavier particles of dust are designed to be removed.

PRINTING PRESSES.—Touro Robertson, New York City. This invention provides a numbering attachment for printing presses, whereby bonds, checks, tickets, etc., may be numbered consecutively, or one or more units may be skipped, as desired, without changing the numbering head or essentially altering its mechanism.

Miscellaneous.

GATE VALVE.—Charles H. Shepherd, New York City. This is a removable gate valve for temporary application to drain and sewer pipes, and is made with a transversely slotted pipe having a collar formed integrally therewith with apertured ears, a cover adapted to close the slot of the pipe, and a gate valve adapted to the bore and slot of the pipe, the improvement being intended to avoid the difficulty from ordinary forms of corrosion.

TAG FASTENER. — William H. D. Ludlow, Tecumseh, Neb. This device is somewhat like a pair of scissors, having at the end of one of its blades a bent tagging extension, pointed, and with an eye for carrying the tag, thread or cord, for putting tags on goods of light and heavy texture, and drawing the string through the goods for the attachment of the tag.

SUSPENDER BUCKLE.—Louis Steinberger, New York City. The body of the buckle is in the form of a flat plate bent over at its sides to form grooved guides to receive margins of the strap, and also slotted to receive crosswise a loose spring gripping plate or bar, between the inner face of which and the back surface of the body the main strap passes, the buckle being readily slid in either direction and automatically effecting its own engagement.

LETTER CLASP. — Louis Steinberger, New York City. This is a clasp made of a piece of spring wire bent and crossed upon itself to form opening and closing frames, to be used for holding letters or loose papers in the pocket or elsewhere, for carrying attached single or double tablets, or for holding books open while being read, etc.

POISON DISTRIBUTER. — Wiley P. Towne, Delta, La. This is a machine having a powder receptacle, with openings connected with flexible tubes or hose having rose nozzles, and a blower entering the receptacle, whereby the powder is distributed in close proximity to the plants to be treated, the wind not blowing it either in the direction of the driver or horses.

SOFA AND BED.—Charles T. Hard, East Liverpool, Ohio. This is an article of furniture adapted to be conveniently and expeditiously converted from one use to another, and is so constructed that when used as a bed the bottom will be amply supported and elevated essentially the same distance from the floor as the equivalent portion of an ordinary bed.

EGG COUNT REGISTER. — Alvin F. Harrison, Greeley, Kansas. This register consists of a case with toothed and numbered disks slightly overlapping each other, the disks having a pin and pivoted lever with spring arm, with other novel features, whereby a party counting eggs can leave the work of counting at any time and will always have an accurate register of his count.

FIGURED WOODEN PLATES. — Robert Himmel, Berlin, Germany. This invention covers a method of producing fancy figured wooden plates, for use instead of inlaid work in furniture, etc., and consists in first burning and pressing the wooden plate between metallic surfaces having patterns on them, and then smoothing and polishing the embossed surface of the plate.

HACK SAW. — George N. Clemson, Middletown, N. Y. This saw has every third tooth arranged in the same plane as the body of the saw, the remaining teeth being set in the usual way to give the saw clearance and prevent it from pinching in the kerf, whereby lateral vibration will be prevented, more perfect work secured, and the usefulness of the saw prolonged.

MEDICATED BOUGIE.—Thomas Christy, London, England. This is a wire instrument, with stem of straight wire bent at one end to form a ring handle, and having a wire extend beyond the straight end and bulging in the middle, the instrument being designed to facilitate the local treatment of various diseases.

UMBRELLA HOLDER. — August Denhard, Bonn, Germany. This holder consists of a main frame of hinged sections which may be folded into small compass, and is adapted to be attached to the clothing, and formed with a fastening device or projection at its upper end, combined with a clamp for grasping and firmly holding an umbrella handle.

HAMMOCK.—Herbert M. Small, Baldwinsville, Mass. This hammock has a seat and back portion, with hooks at the upper end of the latter and a looped rope secured to the forward corners of the seat, with adjustable hooks on the parallel parts of the rope, etc., whereby passengers who have to travel in ordinary passenger cars at night may be able to sleep with ease and comfort.

INDEX.—John P. Findley, Blanchard, Pa. This index is formed in sections on opposite sides of a central starting point of the book, the leaves of the sections being cut away from this point to expose portions of the leaves corresponding to each desired division of the subject matter, making an improved method of forming the index of books.

BILLIARD TABLE.—Charles G. Brockway, Pine Bluff, Ark. This improvement covers a special construction of the table rail and cushion, whereby a better ventilation and adjustment is secured between the bed, the rail, and the cushion, while a solid bearing is obtained for the rail to hold the parts firmly to the adjustment to which they are set.

TELESCOPIC MIRROR.—August Janzon, Iron Mountain, Mich. This is an attachment consisting of a metal or other suitable plate, having a central constructed aperture, a clamp being attached to the plate to hold it upon the outer end of the telescope, with its contracted aperture over or on the outside of the object lens, while a mirror is hinged to one side of the plate, the device being also intended for use with opera glasses, etc.

Business and Personal.

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

NEW BOOKS AND PUBLICATIONS.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Vol. V. Meetings of September 20, 1887, October 11, 1887, November 9 and 15, 1887, December 6, 1887, December 20, 1887, January 10, 1888, February 14, 1888, April 10, 1888, May 16, 1888, June 19, 1888, and October 9, 1888. New York City: published by the Institute. Pp. xii, 435.

In the present age of electrical engineering it is imperatively necessary to keep abreast of the times by reading the proceedings of the societies devoted to the subject. In this volume the proceedings of ten meetings held in 1887 and 1888 are given. It is needless to emphasize their value. Illustrations are given when necessary. The concluding section of the work is devoted to an index of current electrical literature, divided into months, beginning with December, 1887, and ending with September, 1888. The volume has as a frontispiece an excellent photogravure of F. L. Pope, the well known electrical expert.

SEA SIDE AND WAY SIDE. No. 3. By Julia McNair Wright. Boston: D. C. Heath & Co., publishers. 1889. Pp. x, 297. Price 55 cents.

This is the third of the well known nature readers, which have won such popularity in our schools. It is gotten up very handsomely, and from the interest of its topics and the pleasing way in which they are set forth may be recommended to teachers.

SUGAR: A HANDBOOK FOR PLANTERS AND REFINERS. By Charles G. Warnford Lock, F. L. S., Benjamin E. R. Newlands, F.I.C., F.C.S., and John A. R. Newlands, F.I.C., F.C.S. E. & F. N. Spon, London and New York. 1888. Pp. xxiv, 920. Price $10.

This exhaustive work treats of the titular subject in all its phases. Beginning with the cultivation of the sugar cane, the work is carried down through the processes of the extraction and purification of the juice, the reduction of sugar therefrom, the analytical methods, and patented and other processes. The mechanical treat-

ment, as for the production of cube sugar, is given, with appropriate illustrations. The polariscope receives full consideration, and the concluding portion of the work is given to alcohol, its production and distillation. The commercial aspect fills the concluding chapters. The work is well indexed, and forms a standard contribution to the technical knowledge required in the making of sugar.

A NEW PRINCIPLE IN HELIOCHROMY. By Frederic E. Ives. Philadelphia: printed by the author. 1889.

This is an *edition de luxe* among photographic works. It treats of the possibility of producing photographs in natural colors. It is prefaced by the portrait of the author, which, in view of the reputation he enjoys in the photographic world, will be considered an interesting feature of the work. A comparison and criticism of the method used, by Dr. H. W. Vogel, completes the book.

THE VOLTAIC ACCUMULATOR. By Emile Reynier. Translated from the French by J. A. Berly. E. & F. N. Spon, 125 Strand, London; New York: 12 Cortlandt Street. 1889. Pp. xv, 202. Price $4.

The title of this book, brief as it is, describes its contents. It is a treatise on storage batteries, and gives in much detail the theory of their action, their merits, their defects, and a large amount of valuable practical information. A thorough review of the book would be impossible in the space at disposal, but it is enough to say that the subject is admirably treated, and the contents are arranged in the systematic manner that so admirably distinguishes French scientific works.

A LABORATORY GUIDE IN CHEMICAL ANALYSIS. By David O'Brine, E.M., M.D., D.Sc., Professor of Chemistry and Geology in Colorado State Agricultural College. Second edition. Entirely rewritten and revised. New York: John Wiley & Sons. 1889. Pp. 237. Price $2.

This work is intended for the use of students, and is an abstract of qualitative analytical work. The logical way in which it is put forth and its general arrangement are most praiseworthy. A very valuable section is that devoted to poisons, ptomaines, etc., to which 36 pages are devoted; general stoichiometry is the matter of the concluding chapter.

☞ Any of the above books may be purchased through this office. Send for new book catalogue just published.

Address MUNN & Co., 361 Broadway, New York.

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.

(651) H. H. A.—Salt water does not freeze as readily as fresh water, but in the case of shallow running water, whether it be salt or fresh, freezing will sometimes take place first on the bottom, whereas if the water be still the ice particles are ordinarily first formed on the surface.

(652) J. R. N.—We know of nothing practical but chisel and hammer for taking clinkers from fire brick. Burning oyster shells in the fire is sometimes recommended.

(653) W. J. S. asks for receipt for gumming labels. A. Try following:

1. Dextrine	2 parts.
Acetic acid	1 "
Water	5 "
Alcohol	1 "
Or 2. Gelatine	2 parts.
Rock candy	1 "
Water	3 "

(654) J. W. H.—The largest built-up all-steel guns now in actual use in the United States navy are 8 inches. Some 10 inch all-steel guns are now finished or partially finished at the Washington navy yard. The guns on the Boston are 8 inches; 12 inch guns are in course of construction with cast iron shell, steel tubed and steel hooped. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 664, for the "Progress of Our New Navy."

(655) J. J. B. asks: What material, and how applied, is used to coat tin dishes, to withstand the action of chemicals used in developing and toning photos? A. Use a quick-drying asphalt varnish, such as sold for bicycles.

(656) W. F. L. writes for a receipt for a floor varnish that will stand hard wear. What shall I put in to make it a cherry color? A. Use good hard drying varnish from a reputable maker. Color with dragon's blood.

(657) N. C.—Good machinists that are honest and faithful always stand high in the estimation of employers. The country has never had too many of them. The idling, slipshod sort are in excess. We advise you to enter a small shop making any kind of machinery, near at home.

(658) C. H. asks: 1. What is lock jaw and what are its causes? A. Lock jaw or tetanus is a spasmodic disease, characterized by painful, involuntary, and protracted contraction of the muscles. It is almost invarialy consequent upon a wound or injury, although in hot climates and particular localities it may occur without such injury. 2. What are considered the ten greatest works of fiction? A. Opinions differ. Almost all would include "Les Miserables," "Pendennis," "Vanity Fair," "Robinson Crusoe," and some of Balzac's, Dickens', and Fielding's novels in such a list. 3. Who is considered the world's greatest novelist? A. Here opinions also differ. Victor Hugo, Thackeray, Dickens, Fielding or Balzac might be named.

(659) G. W. S. asks a formula for white paint for boat work, also for house work inside. A. Zinc white with a little varnish makes the best finish, and does not turn yellow.

(660) C. H. S. asks: Can you inform me how long it takes electricity to go through the Atlantic cable? A. Practically instantaneously or in a fraction of a second.

(661) G. H. asks: 1. What is the cheapest and easiest process to convert crude pyroligneous acid into commercial acetic acid? A. Neutralize with sodium carbonate, evaporate to crystallization, drain the crystals, heat just enough to decompose any tarry matter, and distill with excess of sulphuric acid. The distillate will be comparatively pure acetic acid. 2. How is crude creosote, as produced by distilling wood, converted into commercial creosote? A. The United States Dispensatory gives the following method of preparation: Creosote is obtained either from wood tar or from crude pyroligneous acid. When wood tar is used, it is distilled until it has attained the consistence of pitch. The distilled liquid divides itself into three layers, an aqueous between two oily layers. The inferior oily layer, which alone contains the creosote, is separated, and saturated with carbonate of potassium to remove acetic acid. The liquid is allowed to rest, and the new oil which separates is decanted from it. This oil is distilled, and yields products lighter than water and a liquid heavier. The latter alone is preserved, and after having been agitated repeatedly with weak phosphoric acid to neutralize ammonia, is allowed to remain at rest for some time. It is next washed as long as acidity is removed, and then distilled with a fresh portion of weak phosphoric acid, care being taken to cohobate from time to time. The oily liquid thus rectified is colorless, and contains much creosote, but also a portion of eupion, or light oil distillate. To separate the latter, the liquid is mixed with a solution of caustic potassa of the density 1·12, which dissolves the creosote, but not the eupion. The eupion, which floats above from its levity, is then separated, and the alkaline solution of the creosote is exposed to the air until it becomes brown, in consequence of the decomposition of a foreign matter, and is then saturated with sulphuric acid. This sets free the creosote, which is decanted, and again distilled. The treatment by solution of potassa, sulphuric acid, etc., is to be repeated until the creosote no longer becomes brown by exposure to the air, but only slightly reddish. It is then dissolved in a stronger solution of potassa and distilled again, and finally redistilled for the last time, rejecting the first portion which comes over on account of its containing much water, collecting the next portion, and avoiding to push the distillation too far. The product collected in this distillation is creosote. When creosote is extracted from pyroligneous acid, the first step is to dissolve sulphate of sodium in it to saturation. The oil which separates and floats about is decanted, and, having been allowed to remain at rest for a few days, is saturated by carbonate of potassium with the assistance of heat, and distilled with water. The oleaginous liquid obtained is of a pale yellow color, and is to be treated with phosphoric acid, etc., as above detailed, in relation to the treatment of the corresponding oil obtained from wood tar. 3. How is acetate of lime made and what is it used for? A. By neutralizing pyroligneous acid with lime. It is used as a source of acetic acid. The literature of the subject is scattered and limited. We can supply you with the part of Spons' Encyclopedia treating of it for 75 cents. In Ure's Dictionary and similar works you will find references to it.

(662) C. W. A. asks: What are the ingredients used and by what process is compressed yeast made, such as is sold in small cubes wrapped in tinfoil? A. Previously malted barley and rye are ground up and mixed, next put into water at a temperature of 65° to 75°; after a few hours the saccharine liquid is decanted from the dregs, and the clear liquid brought into the state of fermentation by the aid of some yeast. The fermentation becomes very strong, and by the force of the carbonic acid which is evolved, the yeast globules are carried to the surface of the liquid, and, forming a thick scum, are removed by a skimmer, then placed on cloth filters, drained, washed with a little distilled water, and next pressed into any desired shape by means of hydraulic pressure, and covered with a strong and well woven canvas. It keeps from eight to fourteen days, according to the season, and is said to be excellent.

(663) H. B. L. asks (1) the standard railroad gauge of England. A. English railroad gauge 4′ 8½″, same as American gauge. 2. Diameter of largest locomotive drivers. A. 78 inches is the largest that we know of in the United States. 3. Why property is leased for 99 years in Illinois. A. The leasing of property for 99 years is not confined to Illinois. It is a very old custom, in use in all the States, derived from English practice. 4. How shellac is bleached. A. Shellac is bleached by exposure in thin strips to the sun. There is a chemical process for bleaching in solution, somewhat complex, described in the "Techno-chemical Receipt Book," which we can mail for $2.

(664) W. G. C. asks: 1. What is the best way to ventilate a store show window to prevent steaming of the glass without letting in dust on the goods? A. For a closed window, where lights are burning, ventilation that shall be as free from dust as possible should be provided by drawing air from above the roof. 4 inch tin pipes from the top of the window, carried up inside of the building through the roof or to a near-by flue, will carry off the moist foul air, while similar tubes from the roof to the bottom of the window will supply fresh air. 2. What is the best way to ventilate a bedroom with ordinary open grate, windows, and doors without causing an unpleasant draught? A. Bedrooms with doors, windows, and grates need no special ventilation when there is a fire in the room. There is leakage of air through imperfect window casings and door crevices to keep the fire burning and supply a chimney draught for ventilating purposes without noticeable draught in the room. At all other times, dropping the upper sash equal to requirements is all that may be needed. If a direct draught is felt, the curtain or a shield may be easily arranged to prevent ill effects.

(665) F. Mfg. Co. ask: Please give a a few suggestions as to gluing wood on metal, for strength and durability. A. Glue with a small percentage of glycerine added adheres well to metals. A small amount of molasses added to glue will act in the same way. Tannin added to glue makes it strong and adherent. Bichromate of potash renders glue waterproof.

(666) A. S. writes: 1. What is the red light used on stage made of? I find some shellac in it. Also give the formula for the green light. A. Mix 4 parts nitrate of strontium with 1 part of pulverized shellac; do not pulverize together. For green use nitrate of baryta. If you substitute an equal weight of chlorate of potash for one or two parts of the nitrate, it will be more vivid. 2. Where can I get seven call bells tuned, or how could I tune them? A. To raise the pitch, turn off near the lip; to lower, turn off the central zone.

(667) R. K.—The emery strap is made by brushing good strong glue upon the leather and quickly sprinkling the surface with flour of emery; when dry, the loose emery is brushed off. Crocus is mixed with a little oil and rubbed into the leather. Smooth on piece of glass.

(668) G. D. D. asks: 1. Can core of armature of simple electric motor be made of Swedish iron, welded and turned, instead of using iron wire, and yet be as good? A. Swedish iron will answer, but not quite as well as the iron wire. 2. Will common iron answer as well as Swedish? A. No.

(669) J. M.—For hardening thin sheet steel, heat in an iron box or pan packed in sand and charcoal equal parts; dip edgwise as nearly vertical as possible. After drawing the temper, the warp can be taken out with a hammer. The charcoal will keep the surface from oxidation, but if necessary to clean the surface, use a bath of muriatic acid 1 part, water 3 parts. A half hour's immersion will clean the surface. You cannot harden satisfactorily by tying the sheets together. Polish with flour emery on a buff or brush wheel wet with oil, gloss with crocus on a buff wet with alcohol. The diamond is easily burned, but fused with much difficulty, losing its transparency and really ceasing to be a diamond.

(670) J. B. S.—A system of Bunsen burners may be arranged under a boiler for house heating. Such are used under small boilers for experimental purposes. The small jet system has also been tried. The cost for heating buildings in this way with other than natural gas has heretofore been a bar to its success.

(671) E. S. K. asks for a good recipe for making a first-class hard lubricant, suitable for heavy or light work, out of the residuum obtained by refining petroleum, and also of a means of removing the disagreeable odor connected with it. A. We fear that you will have trouble in removing the odor you speak of. If it is not very bad, filter through boneblack, or apply the following more complicated process: Heat with steam to 86° Fah. and treat with 10 per cent of sulphuric acid of 60° B. After standing and decanting treat with bichromate of potash dissolved in water. Heat after decanting to 176° Fah. with 10 per cent boneblack, settle and filter. You may mix sperm oil with the residue, but it would be well to wash the petroleum oil with warm dilute solution of soda or lime and afterward with water, before adding the sperm oil.

(672) G. W. T.—The power of a bicycle to ascend a grade depends upon the comparative length of the crank and diameter of the wheel. A short crank on a large wheel does well on level grades, but for hill riding the long crank and smaller wheel is needed.

(673) R. A. C. cannot succeed in changing blue prints to a brown according to formula given in vol. lv., No. 8, page 113. Try the following instead:

Borax	2½ oz.
Hot water	38 "

When cool add sulphuric acid in small quantities until blue litmus paper turns slightly red, then add a few drops of ammonia until the alkaline reaction appears and red litmus paper turns blue. Then add to the solution 154 grains of red crude gum catechu. Allow it to dissolve with occasional stirring. The solution will keep indefinitely. After the print has been washed out in the usual way, immerse it in the above bath a minute or so longer than it appears when the desired tone is reached. An olive brown or a blackish brown is the result.

(674) J. A. G.—The lactometer is used by placing in a vessel of the milk to be tested at a temperature of 60°. If it floats with the 100° mark even with the surface or a little above it, the milk is considered pure. The cream gauge is used by filling with milk and observing what per cent of cream rises to the top. Its indications are of little value. The lactometer is so graduated that as it sinks, the degrees are assumed to indicate the percentage of pure milk. The 100 mark corresponds to a specific gravity of 1·029.

(675) A. S. asks for something better than putty to fill up cracks in a boat. A. Melt equal parts of pitch and gutta percha in an iron pot; thoroughly mix by stirring. Make up in sticks and melt into the cracks with a warm iron.

(676) H. H. asks how to make a small telephone out of baking powder boxes. A. Remove the bottoms. Tie firmly a piece of parchment over the end of each, and attach the end of a string to the center of each parchment by passing it through a hole in the center and knotting it. On stretching the string between the two cans, a species of acoustic telephone system will be formed.

(677) G. M. C.—After 4 to 6 days, when desquamation begins, scarlet fever is especially contagious. Anointing of the patient with vaseline is recommended as a protection against contagion from this cause. As disinfectant for clothes and other dangerous sources of infection, 1 part sulphate of zinc dissolved in 10 parts of water may be used. It is a strong poison. Fumigation with burning sulphur, with bromine, or with chloride of lime and vinegar mixed, are excellent as after treatment of the room, curtains, etc. These chemicals, however, tend to fade or bleach tissues.

(678) G. B. S. asks (1) the lifting power of one cubic yard of best gas for balloon purpose. A. A cubic yard of hydrogen gas will lift 1¼ pounds. 2. The breaking strain of 1⅛ inch best steel cable, and what would a mile length of the same weigh? A. Breaking strain of 1⅛ inches diameter steel rope, 65,000 to 70,000 pounds. Weight per foot 3·14 pounds, or 16,579 pounds to a mile.

(679) A. L. writes: Can the SCIENTIFIC AMERICAN or any of its readers inform me if there is any other way to smooth down the tones of a new violin than by using the bow upon it? A. Give it time and plenty of playing. Many violins have been ruined by being tampered with to improve their tone, when a little patience would have effected the same result. If the violin is of originally poor quality, nothing will perfect the tone.

(680) C. J. C. asks: What method is used in transferring printed matter to glass? A. Soak print in water, varnish glass with dammar varnish or Canada balsam; while still tacky place the print smoothly against it and allow it to dry. When dry, rub off most of the paper with the wet finger and revarnish. The trouble is that printed matter is generally deficient in ink and gives a weak transfer.

(681) J. B. P. writes: In a recent issue, in answer to what will change the odor of turpentine, it gives as changing the odor of naphtha: "Bichromate of potash and sulphuric acid." Can you give me the proportion of each substance used for say one gallon of naphtha or kerosene, and how mixed with the oil, and also whether the mixture is to be warm or cold? A. No fixed quantities can be given. To one pound of oil of vitriol add two ounces pulverized bichromate of potash, and agitate the cold solution with the benzine. After standing long enough to settle, decant the benzine. Use care in pulverizing the bichromate, as inhalation of the dust produces ulcers. Distillation from quicklime with rejection of first and last distillates is recommended also.

(682) G. J. G. asks: Is the vapor of carbolic acid injurious to the lungs? A. It is not generally considered so.

(683) W. J. H. asks: How steel-cased lead rifle balls are made? A. The shells are pressed into shape from thin sheets of soft steel in the same manner as in the making of cartridge shells. The lead is then forced into the shell by a powerful press.

(684) J. F. H. writes: Please give a receipt for preserving eggs, suitable after several months' keeping for food. A. We refer you to SUPPLEMENT, Nos. 65, 107, 308, and 317, which we can supply for 10 cents each.

(685) W. W. G. writes: I want to know if there is any cement made that will withstand the action of sulphuric acid, a light greenish blue color, or how to make it, or if such a cement is made, but of a different color, how to color it? A. Much depends on the heat and concentration of the acid. Sealing wax will stand it under ordinary conditions, but concentrated acid might affect it. The surest thing would be enamel, if you could heat the objects enough to melt it. Generally such cements are dark colored. For blue sealing wax, ultramarine and any dry white such as barytes may be used as coloring matter.

(686) I. E. asks: Is there any means, besides the common method of dry scraping, by which the old paint on furniture may be removed, leaving the natural surface of the wood exposed and uninjured? A. A solution of caustic potash applied to the paint will loosen it in a few hours, or it may be burned off by blistering with a gas jet and small bellows or blower, and scraping before it cools off. An alcohol blowpipe is sometimes used.

(687) G. O. asks: 1. In winding the armature of the simple electric motor with No. 20 wire (motor to be used as a dynamo), should I wind more layers to make up the required thickness, or should I make the polar section of the field magnets smaller? A. If the space to be filled is slight, you might add more wire, otherwise reduce the bore of the field magnet. 2. Also, how many sixteen-candle power lamps would the dynamo light? A. It will probably light one such lamp.

(688) H. G.—As manuals of shorthand we recommend and can supply Burns' Fonic Shorthand, $1, Munson's Complete Phonographer, $1.50.

(689) W. N. G. asks for some reliable recipe that will take lime stains from California redwood? A. Try dilute acid, such as vinegar or lemon juice, or one part hydrochloric acid in fifty parts of water. Experiment on useless pieces of wood until you hit it.

(690) E. S. & S. ask for mixture that will remain sticky on paper exposed to the weather out of doors. A. Use a mixture of raw linseed oil and resin melted together. Vary the proportions until you obtain a suitable consistency.

(691) C. W. B. asks at what temperature water separates into hydrogen and oxygen. A. It depends on the pressure. Water begins to decompose at 1,760° to 1,832° F. It proceeds to a limited extent and stops, and begins again at 2,192° F. The trouble in these investigations is to separate the gases, as otherwise they recombine in cooling. By passing them through a porous tube, the hydrogen diffuses through the pores the quickest, and is thus partially

prevented from recombining. 2. What comparative space do the gases occupy as compared to the water of which they are made? A. 1,844 times the volume of the original water at 32° and 30 inch barometer.

(692) M. S. writes: 1. Will not magnesium ribbon, if heated, unite with chlorine, with the evolution of heat and light? A. Yes. 2. Ayrton, Practical Electricity, p. 11, says: "To specify the strength of the current by the sulphuric acid voltmeter, neither the shape nor the size of the plates need be taken into account within wide limits." My experiments do not seem to confirm that. Is the statement well founded? A. You are wrong, and the authorities are right. 3. If two cylinders equal in size be filled, the one with chlorine, the other with hydrogen, placed mouth to mouth, inverted a few times, and a piece of manganese ribbon be burned near by, no explosion takes place. And yet when a flame is applied at the mouth, the gases explode. Why not with actinic light? A. If the experiment is properly conducted, it will succeed. 4. In Hoffmann's experiment with hydrogen and chlorine, how are the hydrogen and chlorine made to mix? The aperture in the stop cock is 2·5 mm., and yet the gases will not mingle rapidly enough for a class experiment. A. Turn the apparatus so as to have the chlorine uppermost, and after a few minutes reverse it.

(693) H. D. L. asks: Will you please inform me through your paper what is the best light substance that can be used as a deadener or husher of sound? How soft can rubber be obtained, and where? Or is there any way of making it soft? Or quite pliable? A. Cork, sawdust, asphalt concrete, curled hair, or felting are excellent deadeners of sound. Soft rubber can be procured from manufacturers. Its softness depends on the degree of its vulcanization. Possibly sponge rubber, such as used by draughtsmen, would answer your purpose. Once hardened, as by vulcanizing, you cannot soften it.

(694) C. C. J. writes: I have heard that there is a kind of ink which, when you write with it, makes no mark, but when you hold the letter over a lamp, it makes it show like ordinary ink. I would like to know if there is such an ink, and how it is made. A. Dilute sulphuric acid one volume, water twenty volumes, may be used with a quill pen, and will produce the above effect. The writing will be black or dark brown and quite indelible.

(695) C. G. asks: 1. What is fuller's earth, which is used in connection with the fulling of cloth? A. It is a white natural deposit resembling clay, and known as infusorial silica. It is made up of the microscopic siliceous skeletons of diatoms, a minute form of living being. 2. What do they use to bleach cloth? A. Chlorine, the characteristic constituent of bleaching powder, is the great bleaching agent. The cloth to be bleached is subjected to quite an elaborate process, involving treatment with alkali and other chemicals.

(696) L. B. asks: How can I melt or shape rubber to any form (I have the mould), and have a smooth surface, also to have same elastic? What is used to do this with, and where can I get the rubber, or is any rubber good to get good results? A. We refer you to our SUPPLEMENT, Nos. 249, 251, and 252, for full details of rubber manufacture. You must have pure rubber mixed with sulphur, and after pressing it into the mould must vulcanize it by heat while it is held in shape. Any rubber manufacturer can supply the gum ready for vulcanizing. Coat the mould with soapstone, to prevent adherence of the rubber.

(697) Enquirer asks: 1. How electricity is applied to a machine to produce motion. Kindly abstain from technical terms as much as possible. A. For a description of a motor which, if understood, will probably cover your ground, we refer you to our SUPPLEMENT, No. 641, which we can send you for 10 cents. 2. We are told that the cause of the different phases of the moon, such as new, full, gibbous, are formed by the earth casting a shadow on its surface. Now, if such is the case, how is it possible for the earth, which will always cast a convex shadow, as in the new moon, to cast a concave shadow, as it would appear to do when the moon appears in that phase called gibbous? A. If you are so told, your informant is in error. The phases of the moon are caused by the different directions of the sun's rays with respect to the moon's surface. When the shadow of the earth falls on the moon, it is said to be eclipsed. This shadow is always convex.

(698) F. A. writes: I would like to know through your paper whether tobacco using (smoking or chewing) is apt to make a man nervous or not. Can you give me an effective antidote for tobacco habit? A. Excessive use of tobacco may affect the nerves and heart. The best antidote is resolution. Stop using tobacco until the habit is conquered.

(699) J. C. S. writes: I would like to attend some good school, either in New York or Brooklyn, where I could learn how to model and draught boats. A. Your best plan is to enter some ship yard and work in the draughting room, with inspection of the general work in the moulding loft and yard. No school that we know of will answer your requirements.

(700) W. S. asks if glycerine is good for the teeth and gums. A. It is not generally supposed to have any good effect upon either.

(701) J. M. B. asks: 1. Is the spectroscope used to advantage now in analysis, and how is it used? A. It is used largely in scientific investigations, in physics, astronomy, and chemistry. In chemical analysis it is used to a limited extent for detection of the alkalies, sodium, potassium, lithium, etc. The substance is ignited in a colorless flame, and its spectrum is examined. 2. What is the best kind of a spectroscope, and where can I get one? A. A good glass prism spectroscope is probably the best. For dealers in scientific apparatus, consult our advertising columns. If you wish to make one yourself, we refer you to our SUPPLEMENT, Nos. 651 and 672. 3. What work is the best treatise on spectroscopic analysis, and where can I get it? A. We can supply you with Lockyer's Spectrum Analysis, price $2.50, Roscoe's Spectrum Analysis, $5. Also consult the index of our SUPPLEMENTS, which contain much matter on this subject. 4. Can a person take a compound substance and with the spectroscope tell its component parts at once? A. Not generally. It takes experience to use it advantageously, and in actual analysis its use is very limited. In comparatively very few cases it could be thus used.

(702) W. L. C. writes: I should like to ask you if an analysis has ever been made of human saliva; if one has been made, of what ingredients it is composed. I understand that the simplest experiment in voltaic electricity is that in which a piece of zinc is placed on one side of the tongue and a piece of copper on the other: they touch, and a stinging sensation is felt. Now, why cannot a battery be made in which the fluid is a chemical combination made to imitate saliva? This is an original thought, and I hope you will not think it foolish. A. The saliva has been analyzed. As far as regards electric action, the chloride of sodium (common salt) contained in it is the active agent, and has been very extensively used in batteries. It gives a low voltage, and the couple dependent on it alone is quickly polarized.

(703) G. H. S.—For formula for making printers' rollers see Note and Query No. 444, in SCIENTIFIC AMERICAN of March 9, 1889.—For intensifier for wet-plate photo. in line work photo-zinc etching: After fixing the wet plate in a cyanide of potassium solution, intensify with mercury and ammonia as follows:

No. 1.

Water	80 ounces.
Chloride of ammonium	2 "
Dissolve, then add:	
Bichloride of mercury	2 "
Dissolve and filter.	

No. 2.

Liquor ammonia 0·880	5 ounces.
Water	20 "

Dip the plate in No. 1 till it is whitened, then wash, and flow over with No. 2. Another method is as follows. Prepare:

Water	8 ounces.
Ferrid-cyanide of potassium	6 parts.
Nitrate of lead	4 parts.
Dissolve and filter.	

Pour over the plate and keep on till the film is bleached. Wash well under the tap. Then flood with—

Nitric acid	1 oz.
Water	80 "

Allow this to remain on a few seconds, then wash, and flood with—

Sulphide of ammonia	1 part.
Water	5 parts.

which will at once turn the film an intense black; again wash, and flood with the nitric acid solution, again wash, and set the negative up to dry. We quote the above from Wilkinson's work on photo-engraving and etching.

(704) A Subscriber asks how the ever-ready ink pads for rubber stamps are made. A. By saturating the pad with aniline colors dissolved in alcohol and mixed with glycerine. Consult the SCIENTIFIC AMERICAN of Nov. 24, 1888, where you will find an article on type writer ribbon, giving methods for making inks suitable for pads.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the numbers therein given:

(420) How to Perforate Glass.—For the information of E. P. B., (420), page 154, of your paper of March 9, 1889, I would say that I bored two 1⅛ inch holes in crystal plate, without any particular trouble, and now have them mounted, and any one of ordinary ingenuity can do it in the same way. On the fly wheel shaft of my foot lathe there is a wooden pulley, from the side of which projects the crank pin to drive the lathe. The other end of the shaft corresponds. From this pulley I ran an endless cotton rope (clothes line) to a three inch wooden pulley, which I secured to a piece of ⅝ inch pipe, brass, by putting the pipe through a hole in the center of a piece of sheet brass, soldering it to the pipe, and screwing it to the flat side of the pulley. I supported the pipe vertically in maple-wood bearings, all done in a rough way, but put up true. Lubricate with tallow by heating the wood over a fire, enough to melt the tallow in, before you put the bearings on; this will be the only time you need to put tallow for this job. On the lower end of this small pipe solder a piece of copper or brass pipe, of the size you wish the hole in the glass, then put it in the lathe and turn your pulley groove for the endless rope, also face the end of the pipe true, which is to rest on the glass. In the upper end of the pipe place a small funnel; suspend over this a can of water having a plug by which you can let the water drop into the funnel. Get a pound of coarse emery, 10 to 15 cents. To fix your glass, select a place as much out of the way as you can, get an old box or other support, place it where you can run your endless rope to it, level the box and fasten it to the floor. Make a case that will hold your glass and an inch to spare, so as not to pinch the glass; the sides of case are of rough boards, four inches or more high, to protect the glass from accident. In the center of this case fasten a dome-shaped circular piece of board, ¾ of an inch thick, turned true in the lathe. Exactly over the center of this dome place your vertical pipe and pulley, so that it can be raised and lowered in its bearings. Place the glass on the block without any other support, then press the pipe end on to the glass, arranging a spring to give a constant pressure. This will keep the glass level and make it bore faster. Make a ring of putty around the center of the glass, about five inches in diameter, to keep in the emery and water. If the rope slips, make a tightener with a little sash or other pulley, and give the rope a little powdered resin. Now pour emery into the funnel and start the water drip, and while you are running your lathe, making the rest of your machine, you will be boring your glass.—C. R. W.

☞ Books or other publications referred to above can, in most cases, be promptly obtained through the SCIENTIFIC AMERICAN office, Munn & Co., 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

April 2, 1889,

AND EACH BEARING THAT DATE.

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

Adding machine, J. G. & G. W. Smith 400,714
Advertising or display device, A. Dahlstrom 400,549
Air brake, signal, A. B. Collins 400,638, 400,639
Air engine, hydrocarbureted, J. J. R. Humes 400,850
Alarm system, C. A. & J. F. Cox 400,750
Aluminum by electrolysis, reducing, C. M. Hall 400,766
Aluminum from its fluoride salts by electrolysis, reducing, C. M. Hall 400,664
Aluminum, electrolyzing crude salts of, C. M. Hall 400,666
Aluminum, electrolyzing fused salts of, C. M. Hall 400,667
Aluminum, manufacturing, L. Grabau 400,449
Aluminum, manufacture of, C. M. Hall 400,665
Angles for bevel gear, apparatus for plotting, J. A. Boorman 400,737
Asbestos packing, J. B. Deeds 400,755
Asbestos, treating, J. B. Deeds 400,756
Asphalt coated sheet metal pipe, J. P. Culver 400,832
Auger, F. C. Gerard 400,659
Automatic switch, W. X. Stevens 400,802
Axle, E. M. Allen 400,817
Axle box, W. F. Black 400,735
Axle box for locomotives, R. T. Chase 400,545
Axle lubricator, O. F. Mulhaupt 400,784
Axle skein, J. A. Johnson 400,685
Bag holder, G. De Owens 400,551
Battery. See Galvanic battery. Marine battery. Secondary battery.
Bearing, roller, Meneely & Gibbons 400,471
Beehive, Tinker & Kline 400,517
Bells, muffler for signal, E. T. Bates 400,831
Belting, etc., fabric for machine, J. P. Maddox 400,579
Beverage mixer, C. B. Crafton 400,547
Beverage shaking and mixing machine, P. P. Haring 400,674
Bicycles, spring fork for, L. Baudreau 400,737
Binder, temporary, T. Faifer 400,557
Blank heading die, C. D. Rogers 400,794
Board. See Ironing board. Wash board.
Boiler. See Steam boiler.
Boiler, F. L. Waterous 400,529
Book holder, W. H. Ash 400,628
Book leaf or paper holder, E. F. Angell 400,627
Boot or shoe sole and heel plate, G. Meyers 400,867
Boots or shoes, buttonhole piece for, J. Reece 400,485
Bottle necks, machine for shaping, E. H. Everett, 400,555, 400,556
Bottle stopper, W. B. Chambers 400,496
Bottles, machine for corking and wiring corks to, H. La Casse 400,776
Box. See Axle box. Cigar box. Refrigerator packing box. Stuffing box.
Bracelet, A. Luthy 400,578
Brake. See Car brake. Fluid pressure brake. Vehicle brake. Wagon brake.
Brick kiln, D. Laemmle 400,575
Bridge gate, draw, W. Haney 400,672
Bridge, truss, J. W. Paisley 400,704
Bridges, needle beam for, E. E. Runyon 400,874
Brushes, manufacture of, L. W. Nimschke 400,475
Buckboard, J. W. Lawrence 400,576
Buggies, side curtain for, J. W. Thomas 400,809
Building, flat-roofed, J. G. Birely 400,431
Buoy eyes, wear plate for, A. L. Woodworth 400,888
Burden carrier, R. H. Dixey 400,757
Burner. See Gas and vapor burner. Vapor burner.
Burning fluids, device for, W. H. Winegardner 400,618
Bustle, C. A. Allen 400,434
Butter package, C. E. Macomber 400,698
Cables, splicing, J. Collins 400,748
Can opening device, T. Elcoate 400,760
Cans, machine for applying heads to tin, E. L. Jones 400,853
Cans, sealed lock for, W. H. Stoops 400,505
Candle, sulphur, W. G. Crissey 400,444
Car brake, B. Boyer 400,542
Car coupling, W. M. Grisham 400,563
Car coupling, G. W. Lewton 400,695
Car coupling, W. S. Palmer 400,594
Car coupling, F. T. Rogers 400,490
Car coupling, D. H. Royer 400,797
Car coupling, W. G. Stuart 400,508
Car coupling, Whiddon & Bashaw 400,617
Car door, E. B. Goelet 400,562
Car, electric, Condict & Angerer 400,830
Car seat, E. B. Goelet 400,561
Car starter, R. O. Gercke 400,560
Car track sweeper, C. E. Shreve 400,497
Cars, apparatus for heating railway, J. Loftus 400,777
Carrier. See Burden carrier. Cash carrier. Telegraph wire carrier.
Case. See Syringe and medicine case. Thermometer case.
Cash carrier, D. Lippy 400,696
Chair. See Rocking chair.
Chandelier, extension, J. Kintz 400,857
Cheese cutter, B. Barry 400,537
Chuck, lathe, S. Ide 400,459
Churn motor, Strickler & Braddock 400,507
Cigar box with metal or other frame, glass, L. Friedman 400,840
Cigar mould, F. C. Miller 400,868
Cigars, cigarettes, etc., machine for making mouthpieces or holders for, R. W. Thurman 400,806
Cigars, mouthpiece for, T. S. E. Dixon 400,446
Cigarette machine, F. S. Ludington 400,780
Cigarette mouthpieces, or paper tubes, machine for making, G. M. Griswold et al 400,765
Clamp. See Dental rubber dam clamp.
Clamp for clothes lines, tent ropes, etc., S. W. Conklin 400,546
Clevis, A. W. Rumsey 400,493
Clock, W. D. Davies 400,753
Closet. See Columnar closet.
Cloth cutting machine, R. Schofield 400,608
Clothes line, F. P. Stanley 400,503
Coal drilling machine, J. Noice 400,598
Coffin fastener, E. & B. Holmes 400,670
Columnar closet, E. H. Watson 400,614
Condenser, electric, W. Marshall 400,866
Conduit, underground, P. R. Greene 400,764
Conduit, underground, W. Walter 400,510
Cooler. See Milk cooler.
Coupling. See Car coupling. Insulating pipe coupling. Pipe coupling. Thill coupling.
Crib, C. Lawrence 400,693
Crushes. See Ore crusher.
Crystallizing frame, A. E. Beller 400,539
Cultivator, H. G. Emerson 400,837
Cultivator, disk, J. Albertson 400,422
Cultivators, yielding shovel for, E. P. Lynch 400,467
Cutter. See Cheese cutter. Tobacco cutter.
Cutter head, H. L. Haskell 400,567
Cylinder lubricator, A. L. Fillmore 400,653
Dental articulator, Slack & Smith 400,718
Dental fillings, protecting, D. C. McNaughton 400,585
Dental matrix, C. A. Meister 400,587
Dental rubber dam clamp, J. W. Ivory 400,771
Desk, school, A. M. Breadin 400,738
Desk top, W. H. Porter 400,871
Dial, timepiece, C. Bickford 400,734
Die. See Blank heading die.
Disinfecting apparatus, E. Clarenbach 400,487
Distilling fat acids, apparatus for, P. Marix 400,469
Ditching machine, J. Lalonde 400,859
Door check, G. W. Wright 400,815
Doubling machines, etc., stop motion for, A. A. Lehmann 400,694
Drawer pull, A. H. Jones 400,852
Electric circuit switch, S. Bergmann 400,733
Electric circuits, safety device for, W. J. Hammer 400,669
Electric currents, regulating, J. W. Balet 400,726
Electric currents, switch device for, J. A. Turner 400,808
Electric distribution, transfer system of, E. W. Rice, Jr 400,496
Electric machine, dynamo, J. B. Entz 400,888
Electric, magnetic, or electro-magnetic forces by weight, determining the value of, A. Gipperich 400,662
Electric motors and generators, prevention of sparking in, D. Higham 400,680
Electric or magnetic forces, apparatus for determining, A. Gipperich 400,661
Electric reciprocating engine, alternating current, C. J. Van Depoele 400,809
Electric switch, L. Bergmann 400,732
Electrical energy by induction, secondary generator for the conversion of, Lowrie & Hall 400,862
Electricity by secondary batteries, distribution of, W. W. Griscom 400,843
Electro-magnetic forces by weight, apparatus for determining the value of, A. Gipperich 400,663
Elevator, I. H. Venn 400,613
Engine. See Air engine. Gas engine. Electric reciprocating engine. Motive power engine. Pumping engine. Steam engine. Tide and lock power engine. Traction engine.
Engine lubricating device, steam, A. L. Ide 400,682
Engines, reversing mechanism for, J. W. Stringer 400,805
Envelope, sample, G. S. Van Woert 400,524
Eraser, chalk, W. H. Londergon 400,465
Extension table, E. L. Matteson 400,701
Faucet, W. W. Kimball 400,691
Feed mill, A. L. Eppley 400,447
Feed regulator, J. B. Wheatley 400,720
Feed water heater and purifier, M. W. Hazelton 400,677
Fence, R. J. Reimer 400,711
Fence building, D. R. Barton 400,429
Fences, tension device for wire, D. H. Scott 400,606
Fertilizer distributer, J. Bender 400,731
Filter, A. Wilbur 400,884
Filter, water, Blake & Wilson 400,736
Fin for vessels, G. W. Napier 400,592
Firearm, breechloading, C. M. Rider 400,712
Firearm, magazine, Mieg & Bischoff 400,472
Firearm sight, J. J. Speed 400,715
Fire escape, J. Flynn 400,656
Fire escape, C. A. Luce 400,779
Fire escape, C. O. Rose 400,873
Fire extinguisher, automatic, C. W. Kersteter 400,688
Firepot linings, joint for, S. D. Horton 400,848
Forging machine, H. Hammond 400,670
Frame. See Crystallizing frame.
Furnace. See Gas furnace. Hot air furnace.
Furnace grate for portable engines, S. E. Burke 400,834
Furnaces, smoke preventer for, H. E. Piggott 400,709
Fuse or igniting device for projectiles, W. Kennish 400,687
Galvanic battery, E. H. Crosby 400,480
Game counter, J. Hope 400,770
Gas or vapor burner for heating, O. Rotton 400,802
Gas engine, A. Histon 400,458
Gas fixtures, electric lamp attachment for, E. F. Gennert 400,658
Gas furnace, R. Cartwright 400,827
Gas lighter, electric, J. Y. Parke 400,479
Gas lighting device, electric, D. Rousseau 400,492
Gas mains, service pipe connection for, G. Westinghouse, Jr 400,532
Gas outlets, forming, W. M. Jackson 400,683
Gasometer, W. B. Hammond 400,671
Gate. See Bridge gate. Swinging gate.
Gate, T. Tyson 400,511
Gem, imitation, S. Grossiord 400,450
Glass through the annealing tunnel, device for conveying sheets of, P. Pfeifer 400,708
Glove fastener, G. W. Mandrill 400,865
Goods, apparatus for the delivery of, prepaid, W. H. Bailey 400,536
Gopher exterminator, M. B. Parker 400,705
Grain meter, G. B. Howland 400,849
Grain meter, Weber & Harrison 400,615
Grinding mill, E. T. Williams 400,533
Grinding pan, P. Hinkle 400,681
Grinding shimer moulding bits, etc., machine for, H. C. Gilbert 400,660
Grip testing machine, coin-operated, P. Evecitt 400,849
Gun, magazine, L. L. Hepburn 400,679
Harness loop, E. B. Knapp 400,461
Harrow, P. C. Loveland 400,861
Harrow, H. L. Mack 400,697
Harrow and drag, combined, G. Mullennix 400,786
Harrow attachment for land rollers, J. W. Weir 400,616
Harvester, cotton, S. D. T. Manning 400,700
Harvesters, cutting apparatus for, Robinson & Collins 400,489
Hats, bottom board for, C. E. Keator 400,773
Hay rake and stacker W. D. Watkins 400,530
Heat regulating device, automatic, Butler & Rosenberger 400,836
Heater. See Feed water heater.
Heating apparatus, L. B. Hartung 400,453
Hides or skins, apparatus for treating, C. W. Cooper 400,443

Hides or leather scraps, agitating, C. W. Cooper, 400,441, 400,442
Hinge, lock, Boughn & Cashner, 400,540
Holdback, Wilson & Hough, 400,811
Holdback for vehicle thills, M. E. Campany, 400,485
Holder. See Bag holder. Book holder. Book leaf or paper holder. Lamp shade holder. Whip holder.
Hook. See Snap hook.
Hook, C. Smith, 400,501
Horseshoe, D. S. Jaffray, 400,684
Horseshoe and pad, S. Thompson, 400,514
Horseshoes, device for removing calks from, G. W. Wemple, 400,531
Hot air furnace, A. Williams, 400,886
Huller. See Rice huller.
Illuminating composition, T. J. Fealy, 400,651
Inhaler, J. S. Hooker, 400,789
Insect trap, C. G. Jennings, 400,460
Insect trap, G. J. F. Johnson, 400,572
Insulating pipe coupling, F. C. Rockwell, 400,600
Iron. See Sad iron. Soldering iron. Vehicle rub iorn.
Iron ore, dephosphorizing, T. F. Witherbee, 400,622
Ironing board, J. M. Sebold, 400,799
Ironing machine, G. Heidel, 400,678
Joint. See Strap joint.
Joint fastenings, machine for making, C. T. Remus, 400,792
Kiln. See Brick kiln.
Knife. See Pruning knife.
Knitting machine, circular, C. F. Swain, 400,510
Ladder, folding, Low & Sullivan, 400,773
Lamp, arc, G. M. Lane, 400,692
Lamp, Argand, L. J. Atwood, 400,819
Lamp, electric arc, S. E. Nutting, 400,476
Lamp extinguisher, C. M. Brown, 400,743
Lamp extinguisher, A. E. McLeod, 400,584
Lamp extinguisher, C. M. Postlethwaite, 400,789
Lamp shade holder, J. Kints, 400,854
Lamp shade support, J. Kints, 400,855
Lamp, suspension, J. Kints, 400,856
Lamps, device for supporting electric, Moore, Jr., & Fitch, 400,473
Lamps, lens fastening for, J. S. Gail, 400,763
Last, E. W. Stead, 400,876
Latch, B. L. Wright, 400,814
Lathe, metal turning, J. R. Back, 400,820
Lathe, turning, R. F. Darling, 400,550
Lathing, metallic, I. Kinney, 400,774
Lightning arrester, M. D. Law, 400,463
Lightning rod and coupling, S. R. Lawshe, 400,464
Lock. See Seal lock. Switch lock. Vehicle seat lock.
Lock, F. Krupp, 400,858
Locomotives, push bar for, M. D. Toohey, 400,518
Log loading machine, Pratt & Hanson, 400,730
Logs and timber, device for handling, W. Baptist, 400,728
Loom shuttle motion, J. L. Brook, 400,742
Looms, operating mechanism for the cloth beams of, C. Straumann, 400,879
Looms selvage shedding device for hand, H. S. McKean, 400,563
Lubricator. See Axle lubricator. Cylinder lubricator. Pulley lubricator.
Lubricator, L. M. Fleischmann, 400,761
Magnetic separator, G. Conkling, 400,746, 400,747
Malting grain, apparatus for, P. G. Toepfer, 400,807
Map, H. B. De Beaumont, 400,642
Marine battery, revolving, L. Durand, 400,896
Match safe, J. K. Robinson, 400,488
Medical compound, Levering & Curry, 400,577
Medical compound, A. Roberts, 400,793
Medicine spoon register, H. W. Welles, 400,719
Meter. See Grain meter.
Middlings purifier, G. W. Bell, 400,538
Milk cooler, F. A. & I. A. Dodge, 400,834
Mill. See Feed mill. Grinding mill. Rolling mill.
Mould. See Cigar mould.
Moulding machine, sand, J. N. Matlock, 400,781
Moulding machines, cutter head for, P. J. Hardy, 400,673
Motive power engine, Debouttevillo & Malandin, 400,754
Motor. See Churn motor. Railway motor. Water motor.
Nozzle, spray, J. Bean, 400,730
Oil or petroleum, refining and deodorizing coal, F. M. F. Cazin, 400,633
Order, credit or store, C. S. Hempstead, 400,569
Ore crusher, J. Rodermond, 400,601
Ore separator, J. Coombes, 400,440
Packing, rod, Cockfield & Higgins, 400,438
Pail, dinner, P. L. Crossman, 400,752
Pail, fisherman's, Meyering & O'Connor, 400,568
Painting machine, shingle or sheet metal, G. D. Armstrong, 400,426
Pan. See Grinding pan.
Paper cutting machine, H. P. Feister, 400,652
Paper folding machine, Fowler & Henkle, 400,662
Pavement, street, H. S. Hallwood, 400,767
Petroleum, apparatus for refining, F. M. F. Cazin, 400,634
Phonogram blank, T. A. Edison, 400,648
Phonogram blanks, making, T. A. Edison, 400,649, 400,650
Phonograph, C. Batchelor, 400,629
Phonograph, T. A. Edison, 400,647
Phonograph doll, W. W. Jacques, 400,851
Phonograph recorder and reproducer, T. A. Edison, 400,646
Pick, H. C. Stouffer, 400,803
Pipe coupling, J. C. Bayles, 400,822
Pipe coupling, S. R. Dresser, 400,644
Pipe coupling, R. J. Edwards, 400,759
Pipe laying apparatus, D. A. Streeter, 400,881
Pipe welding machine, R. Cartwright, 400,829
Pipes, composition for, J. H. Walsh, 400,527
Planter and cultivator, D. B. Henry, 400,456
Planter and fertilizer distributer, corn, J. B. Broadwell, 400,740
Pliers for applying couplings of wire, H. D. Taylor, 400,512
Plow, E. P. Lynch, 400,468
Plow and plow point, J. W. McAnulty, 400,581
Plow, corn, Quillan & Dake, 400,710
Plow, hillside, M. J. Bunnell, 400,434
Plow, sulky, C. Boulay, 400,433
Pressure brake, fluid, G. A. Boyden (r), 10,993
Pressure regulator, C. Dubois, 400,553
Printing and delivering mechanism, web, L. C. Crowell, 400,548
Printing machine sheet delivery apparatus, W. Scott, 400,875
Printing presses, numbering attachment for, T. Robertson, 400,599
Protector. See Thread protector.
Pruning knife, L. H. Sholder, 400,800
Pulley, R. C. Paul, 400,706
Pulley lubricator, loose, C. W. Wilder, 400,885
Pulley, split band, A. Kehler, 400,574
Pulverized substances, receptacle for, F. Kampf, 400,696
Pump, C. Bagley, 400,428
Pump, lift, R. N. Roach, 400,487
Pump, steam, S. J. Parker, 400,787
Pump, vacuum, J. T. Hambay, 400,668
Pumping engine, steam, F. Steinmann, 400,877
Rack teeth, automatic machine for cutting, U. & H. E. Eberhardt, 400,645
Rail cutting machine, T. G. Perkins, 400,707
Railway and railway vehicle, G. W. Brown, 400,544
Railway motor, Valentine & Grigg, 400,522
Railway rail tie and fastening, J. Frysinger, 400,558
Railway signal, S. T. Street, 400,880
Railway signal, automatic, J. Oxley, 400,703
Railway signaling, electrical, W. H. Waddell, 400,525
Railway switch stand, C. Alkins, 400,816
Railway switch stand, G. F. Gage, 400,657
Railway tie and fastening, metallic, H. L. De Zeng, 400,643
Railways, conduit for cable, E. C. Phillips, 400,492
Railways, trolley for electric, D. A. Ainslie, 400,725
Railways, trolley for electrical, D. A. Ainslie, 400,724
Rake. See Hay rake.
Ratchet wrench, W. H. Whitmore, 400,722
Recorder. See Phonograph recorder.
Refrigerating and ventilating car, Lucas & Wood, 400,568
Refrigerating tower, A. R. Pechiney, 400,595
Refrigerator packing box, Hohmeier & Ball, 400,768
Register. See Medicine spoon register.
Regulator. See Feed regulator. Pressure regulator. Temperature regulator.
Rice huller, H. Scholfield, 400,604
Rice, treating, E. V. Donelson, 400,895
Rings, forming, J. Bowden, 400,541
Rocking chair, L. C. Gunn, 400,564
Rocking chair, W. L. Paine, 400,478
Rod. See Lightning rod.
Rolling metals, rolls for, J. Guest, 400,845
Rolling mill, J. Guest, 400,844
Rolling mill, J. S. Seaman, 400,495
Rule, dress cutter's, T. I. Stockman, 400,504
Rule working machine, R. Atwater, 400,818
Ruler, parallel, Phelps & Ellis, 400,596
Sad iron, A. Rosa, 400,796
Safe or vault, M. Siersdorfer, 400,499
Sash fastener, J. W. Atwood, 400,535
Sash fastener, W. F. Elkins, 400,554
Sash, machine for grooving window, F. V. Phillips, 400,597
Satchel attachment, J. A. Yarger, 400,624
Saw guide, Sleeper & Woodard, 400,801
Scissors, E. Peters, 400,480
Scraper, road, P. Raab, 400,483
Scraper, wheel, T. Rebhols, 400,791
Screen. See Window screen.
Screw taps, machine for cutting, G. W. Tower, 400,882
Seal lock, O. E. Davidson, 400,445
Seat. See Car seat.
Seat, G. J. Wolber, 400,623
Secondary battery, W. W. Griscom, 400,842
Secretary and dresser, combination folding, A. Shields, 400,607
Seed for planting, preparing cotton, G. W. Newell, 400,786
Separator. See Magnetic separator. Ore separator.
Sewing machine, E. Bruncker, 400,744
Sewing, machine, boot or shoe, W. Comey, 400,439
Sewing machine buttonhole attachment, G. D. Spielman, 400,608
Sewing machine feed mechanism, J. W. Dewees, 400,833
Sewing machine, glove, C. M. Boland, 400,432
Sewing machine quilting attachment, C. Mandeville, 400,699
Sewing machine tuck creasing and marking attachment, A. A. Crawford, 400,751
Shirt waist, E. W. Wheeler, 400,721
Shoe, P. Caspary, 400,632
Shoe fastening, S. Wilson, Jr., 400,812
Shutter worker, J. O. & A. O. Shatsick, 400,496
Sifter, rotating wave generating, F. G. Winkler, 400,620
Sifting granular material, F. G. Winkler, 400,619
Sifting machine, F. G. Winkler, 400,621
Signal. See Air brake signal. Railway signal.
Sisal, etc., treating, A. W. Montgomery, 400,782
Snap hook, Tainter & Noble, 400,511
Snow plow, railway, McCarthy & Moran, 400,582
Snow scraper, G. J. Kopmeier, 400,775
Solder and flux, combined, Norton & Hodgson, 400,869
Soldering iron, Sundeen & Molander, 400,509
Soldering iron, self-heating, Heidel & Frey, 400,455
Soldering pipe joints, submarine apparatus for, F. Rann, 400,484
Spark coil, F. H. Root, 400,795
Spectacle lens, A. Morck, Jr., 400,783
Speculum, W. Molesworth, 400,589
Spinning and twisting machines, stop motion device for, W. Lund, 400,864
Spinning spindle, Smith & Gill, 400,502
Spring. See Vehicle spring.
Stairway, spiral, G. V. Marshall, 400,470
Stamp, hand, E. W. Lehman, 400,860
Stand. See Railway switch stand.
Steam boiler, W. T. Bate, 400,729
Steam boiler, J. L. Gill, Jr., 400,448
Steam boiler, S. P. Hedges, 400,568
Steam boiler, H. A. Kroeschell, 400,462
Steam engine, C. O. Heggem, 400,847
Steam engine, compound, M. Coryell, 400,641
Steam trap, W. A. Taylor, 400,718
Stool, piano, H. Walther, 400,528
Stool, sectional camp, C. F. Glocker, 400,841
Stopper. See Bottle stopper.
Stove, F. Veil, 400,612
Stove, heating, A. S. Phelps, 400,481
Stoves, recess summer piece for, J. H. Keyser, 400,689
Straight edge or darby, E. Moore, 400,590
Strap joint, C. T. Remus, 400,872
Straw stacker, A. A. Russell, 400,798
Stuffing box, W. E. Brockett, 400,543
Swinging gate, T. E. Brodt, 400,631
Switch. See Automatic switch. Electric switch. Electric current switch.
Switch lock, May & Spikins, 400,560
Swivel, double-acting, M. Collins, 400,749
Syringe, D. C. McNaughton, 400,586
Syringe and medicine case, combined, G. B. Ross, 400,491
Table. See Extension table.
Tank. See Wash boiler tank.
Tank, H. W. Harry, 400,566
Targets, machine for making bird, M. E. Pontious, 400,870
Tea kettle, C. E. Coats, 400,635
Telegraph wire carrier, R. S. Donaldson, 400,552
Telegraphy, harmonic, F. Van Rysselberghe, 400,523
Telephone transmitter, W. J. Morton, 400,591
Telephones, arm support for, C. R. Tuttle, 400,520
Telescopic glasses, mirror attachment for, A. Janzon, 400,571
Temperature regulator, L. F. Easton, 400,758
Thermometer case, C. J. Tagliabue, 400,717
Thermometer, oven, Julier & Robinson, 400,573
Thill coupling, D. K. Stone, 400,878
Thill coupling, B. E. Wade, 400,526
Thread, L. Briggs, 400,739
Thread protector, E. J. Colby, 400,636
Tide and lock power engine, A. F. Smith, 400,500
Tie. See Railway tie. Railway rail tie.
Tile or brick, paving, C. M. O'Conner, 400,477
Tobacco cutter, J. B. Adt, 400,723
Tool, combination, A. D. Kimball, 400,690
Traction engine, C. O. Heggem, 400,846
Transformers, apparatus for regulating current or potential in secondary of, E. Thomson, 400,515
Transformers, regulating current or potential in secondary of, E. Thomson, 400,516
Trap. See Insect trap. Steam trap.
Trimming machines, rotary cutter for, M. D. Phelan, 400,786
Truck loader, J. D. Hill, 400,457
Truss, J. Hayden, 400,454
Tube or pipe sections, locking device for, J. W. Teetzel, 400,513
Tunnel, sub-river, A. W. Straub, 400,804
Typewriting machine, C. Spiro, 400,716
Umbrellas or analogous articles, holder for, A. C. Porter, 400,598
Valve gear for steam hammers, S. Trethewey, 400,519
Vapor burner, C. H. Shults, 400,498
Vehicle brake, A. H. Wilson, 400,887
Vehicle rub iron, D. Guile, 400,451
Vehicle running gear, E. W. Jenkins, 400,772
Vehicle seat lock, J. N. Corey, 400,640
Vehicle spring, L. Stouffer, 400,506
Vehicle trace loop, O. V. Blasier, 400,630
Ventilating apparatus for vehicles, J. J. Geraghty, 400,559
Wagon brake, Hartman & Clay, 400,675
Wagon brake lever, W. A. & E. G. Haney, 400,565
Wagons, advertising panel for delivery, E. A. Culver, 400,831
Walls or ceilings, furring strip for, J. Twichell, 400,521
Wash board, S. Bingham, 400,823
Wash boiler tank, J. W. Anderson, 400,425
Washing machine, B. Brobst, 400,741
Washing machine, S. M. Cole, 400,637
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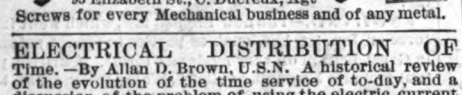

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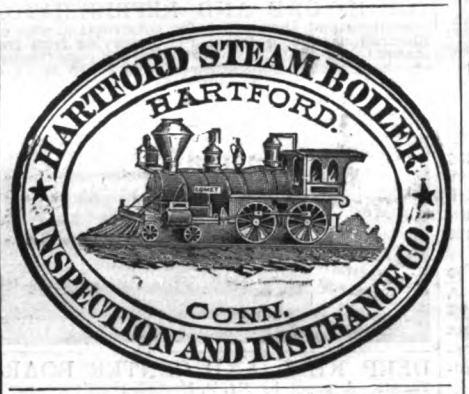

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