SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LVI.—No. 17. [NEW SERIES.] NEW YORK, APRIL 23, 1887. [$3.00 per Year.

EIGHT LIGHT DYNAMO.

BY GEO. M. HOPKINS.

Unfortunately for the tyro in electrical matters, no rule or set of rules exists in the literature of dynamo-electric machinery which would enable him, with entire confidence of success, to plan a new form of dynamo, or even to attempt to construct any one of the well-known forms. The available information generally fails in some minor details, thus, in some degree, obscuring the whole subject, and awakening doubts as to the best course to pursue. One might follow such information as closely as possible, and proceed so far as to make an operative machine, and yet it might happen that no current could be evoked from it, simply for the want of specific knowledge as to how to secure the first increment of magnetism necessary for starting the inductive process.

The writer knows a case in point where good workmanship, proper proportions, and correct connections failed of giving any results whatever. Naturally, rewinding was resorted to, but to no purpose. Other experiments were tried, with no better results. But, finally, acting upon a hint given by a builder of dynamos, the maker of the machine was out of his difficulty almost in an instant.

It is not the purpose of the present paper to treat on dynamos in general, but to give, as fully as possible, specific information as to the construction of a small dynamo-electric machine capable of supplying a current for eight sixteen-candle power incandescent fifty volt lamps, or a larger number of smaller incandescent lamps of suitable resistance, or an arc lamp of ordinary power. The armature speed is 2,200 revolutions per minute, and the machine running normally requires one horse power to drive it. The machine weighs 130 pounds, and occupies a floor space of 8 × 18 inches.

The dimensions of the machine are tabulated below:

Height of field magnet	13	inches.
Length of field magnet waist	6⅞	"
Width of field magnet waist	5⅜	"
Thickness of field magnet waist	1⅝	"
Depth of polar extremities from waist to base	4½	"
Width of polar extremities	6¾	"
Thickness of polar extremities	3	"
Diameter of bore of polar extremities	3⅝	"
Thickness of yoke	1⅞	"
Diameter of bolts passing through the yoke	⅝	"
Length of armature shaft	18	"
Diameter of armature shaft	⅝	inches.
Diameter of armature shaft bearings	½	"
Length of parallel faces of armature	6¾	"
Diameter of iron rings of armature core, outside	3	"
Diameter of rings of armature core, inside	1⅞	"
Thickness of rings	5/32	"
Number of iron rings on armature core	39	
Diameter of wooden armature core	1⅞	"
Length of wooden armature	6⅝	"
Length of armature core	6⅝	"
Number of divisions of the armature core	24	
Number of divisions of the commutator cylinder	24	
Length of commutator cylinder	2	inches.
Width of brushes	13/16	"
Size of wire on armature, No. 20 Am. W. G.	0·027	in diam.
Length (approximate) of wire in each armature coil*	25	feet.
Number of convolutions in each layer	8	
Number of convolutions in each coil	16	
Number of layers in each coil	2	
Number of coils in each space of the armature	2	
External diameter of armature	3⅜	inches.
Weight of wire on armature	2¼	pounds.
Diameter of pulley on armature shaft	3½	inches.
Width of pulley on armature shaft	2½	"
Width of driving belt	2	"

(*Continued on page* 261.)

* This quantity varies a few inches with the different coils.

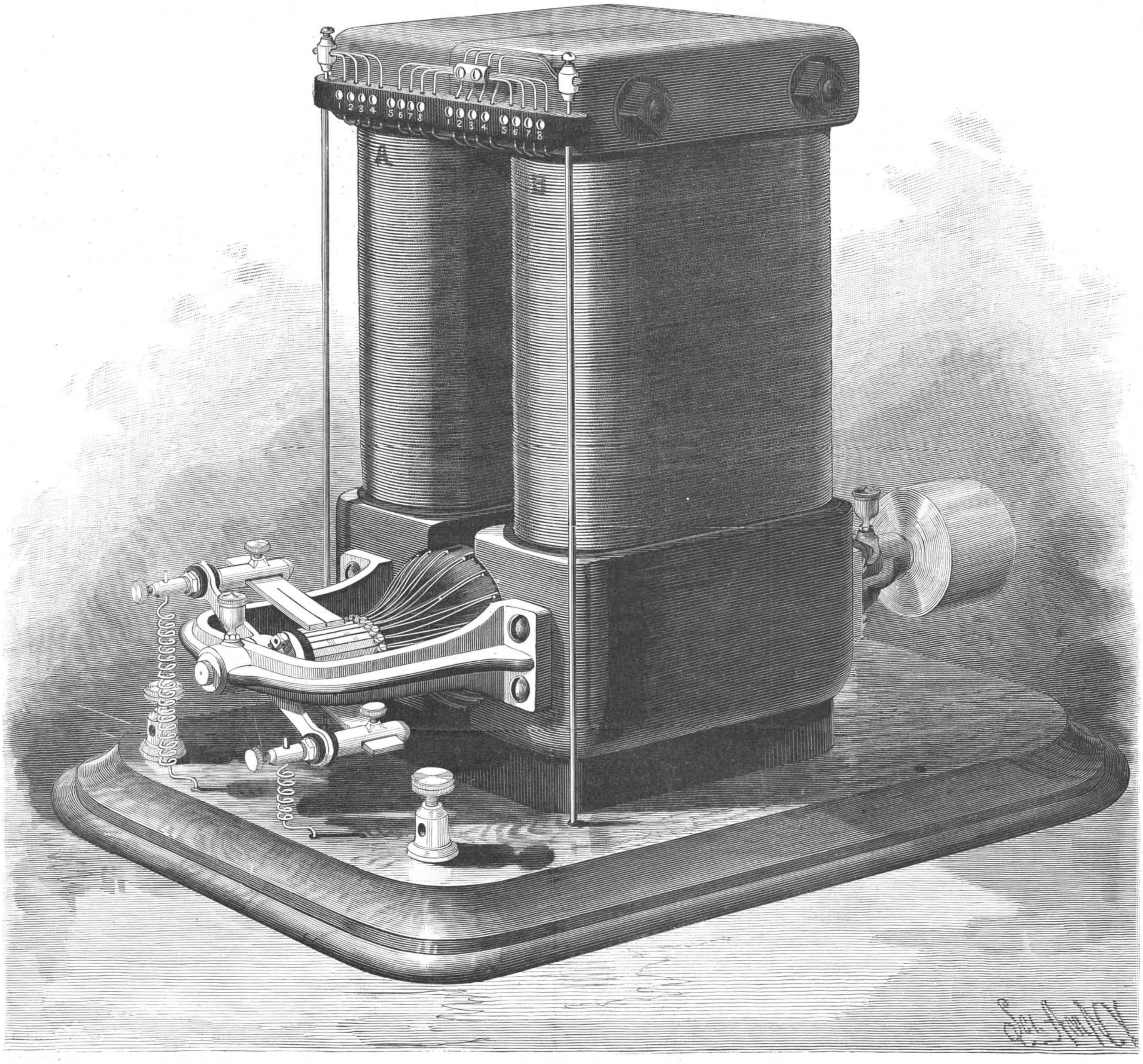

Fig. 1.—EIGHT LIGHT DYNAMO.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

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NEW YORK, SATURDAY, APRIL 23, 1887.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 590.

For the Week Ending April 23, 1887.

Price 10 cents. For sale by all newsdealers.

NEW PROCESS FOR THE PROTECTION OF IRON.

The problem of preserving iron from oxidation may fairly be termed one of the great issues of the present day. Hitherto it has been effected in widely opposite ways. One method has consisted in converting its surface into an oxide, another in applying paint or enamel, another in coating it with zinc—a metal more readily attacked than itself. All these methods bear the aspect of being expedients merely, and do not present a definite solution of the problem.

Of all the ordinary metals, lead, which resists some of the stronger acids, such as sulphuric or hydrofluoric, may be regarded as the most durable. A new process for coating iron with an adherent layer of this metal has recently been discovered and perfected by Mr. F. J. Clamer, of the Ajax Metal Co., of Philadelphia. By it the iron is covered with a uniform coating of silvery lead. The roughnesses and indentations of the iron receive the lead, as well as the smooth parts. The result is a perfectly protected piece as long as the lead endures, and it is practically everlasting. No oxidation can affect the iron.

We have before us some admirable specimens of work done under this new process. It is specially adapted for the protection of sheet iron for car and other roofing, for spikes, bolts, nuts, pipes, boiler tubes, water tanks, iron bridges, and wherever the protection of iron or steel, wrought or cast, is desired. Its cost is no greater than that of the ordinary zinc or galvanic process. The superior excellence of the new method, its comparative cheapness, and the wide range of its applications, mark it, in our opinion, as one of the most important of recent improvements in the useful arts.

SEA LIONS IN CENTRAL PARK.

The little artificial pond in the rear of the lion house in the Central Park is now occupied by a group of interesting visitors from Alaska. They drowse lazily upon the stone coping of the banks, and, tiring of this, wabble awkwardly to the brink and dive deep into the limpid depths below. When at home in the cold North, they keep a sharp eye out for bears and sealers while lying upon the frozen rocks, and must devote a large portion of the day a-fishing, else they will be supperless. Here there is no one to disturb them; their only neighbors being a pair of taciturn pelicans and a sad-eyed stork who seems to have one leg more than he has any use for. They no longer have to catch fish for a living, a supply being fetched them daily from the Fulton Market stalls; and perhaps the only flaw in what might be an ideal existence is that they are unable to name the quality of the fish they prefer on certain days.

These newly arrived visitors are called sea lions, though why such inoffensive looking creatures should have so terrible a name it is hard to understand; and the visitor to the park, after taking a good look at the lords of the forest as they pace their cages in haughty fretfulness only a few steps distant, will scarcely see any resemblance in these mild-eyed, almost timid, creatures. They came from Alaska by boat, though fully able to swim the entire distance, and, being landed in San Francisco in four large crates, they were transferred to a great refrigerator, in which they journeyed hitherward, wondering, perhaps, as they gazed through the slats of the car, how the natives of the country through which they passed could find it so very warm.

There are eight of these sea lions in all, five cows and three bulls, and it was an interesting sight to see them removed from their separate crates on the bank of the little pond. A big bull, some eight feet long, was the first released. He craned his neck, thrust his nose high in the air, and took a good sniff, and then, catching sight of the water, shuffled over to the coping, poised himself on his flanks, described a crescent with his back, dipped his nose, and the loose jointed, loose skinned body seemed to leave ground in series, and to describe the same curve as that which had been traced by his nose. He remained below about a minute, and reappearing set up a terrific roaring, which may have meant that he found the pond neither deep nor salt enough, and disappeared just in time to miss the answering roars and gruesome howls which came from the lion and tiger dens hard by. The other sea lions seemed anxious to miss them too, for they hastily waddled over to the water and disappeared. The only exception was a cow sea lion, who stubbornly refused to leave her dead calf—it died during the journey hitherward—and three men were engaged in the struggle before the dead infant could be removed. Four of the sea lions steadily refused all offers of food, and have not broken their fast since their capture, some three months ago. This is a peculiarity of seals, large and small, for, though tenacious of life and easily tamed, they will often refuse to eat for many months while in captivity, living apparently on their own tissue, as in hibernation.

As to the exact genus of these sea lions, it is not easy to say with anything like certainty, there being much difference of opinion among the authorities. It resembles Steller's sea lion (*Platyrhynchus*, Stelleri, Less.), though by no means so large, for this is sometimes 15 feet long. Though harmless in appearance, these sea lions are really very fierce at times. They eagerly attack and always defeat the sea otter, often much larger, and having powerful teeth. They will even attack a boat when they are wounded, and the sea bear (O. [A.] *Ursina*, Cuv.) flees at their approach. The sea lion has a keen scent and good sight in a dim light, such as prevails during Arctic winters and in polar seas.

They are very tractable, and have been taught to turn an organ, stand erect on the hind limbs, shoulder a gun, and shake hands.

It is the sea lion which it is supposed that Jason, in the mythological story of the Argonautic expedition, mistook for sirens, who sat upon the adjacent shores and essayed to allure his crew by their singing. Orpheus' superior music kept them aboard, however, and the quest for the Golden Fleece was not interrupted.

DANIEL DAVIS.

On March 22, at the age of 74 years, Daniel Davis died at Princeton, Mass. Forty years ago he was one of the leading electricians of this country. He was born at Princeton, and worked on his father's farm until he attained the age of 20 years, when he came to Boston. After working in the soda factory of Mr. Darling, he became acquainted with Dr. William King, a manufacturer and dealer in static electrical machines, and who also erected lightning rods. The flat copper rod now on the Boston court house was put up by Mr. Davis, for Dr. King. Eventually, after various business changes, he began business alone in 1837 as a manufacturer of electro-magnetic apparatus. He had as an associate in much of his work Dr. Charles G. Page, the well known inventor. In 1847, he published "Davis' Manual of Magnetism," one of the earliest works on the subject.

He did not patent his inventions, many of which would have yielded very large returns. Thus, the invention of electrotyping in copper for reproduction of type and engravings is attributed to him. He reproduced by electrotypy the arm of a girl; the object is said still to be in existence. He was the pioneer in this country of gold and silver plating. Many medals and awards testify to his achievements. He developed and improved Morse's telegraph, making a practical system out of the not fully developed devices of Morse. Many of the scientists of the day were intimate with him and interested in his work. Among them the names of Hare, Silliman, Henry, Abott, Farmer, and Webster are given. In 1852 he retired to his farm, relinquishing science for agriculture. He died comparatively unknown, as he suffered the march of progress to go by him.

THE CELESTIAL WORLD.

THE CONJUNCTION OF SATURN AND DELTA GEMINORUM.

The planet Saturn cannot fail to be easily recognized in the western sky in the early evening, as the twin stars, Castor and Pollux, on the north, plainly point out his position in the sky. He is an interesting object, for his light is soft and serene, and his color is like that of pale gold.

Keen-eyed observers will see with the naked eye a star of the third magnitude a little way east of the planet. We wish to direct attention to this star. It is known on star records as Delta Geminorum, and Saturn will be in conjunction with it on the 25th of April, at 9 o'clock in the morning, being at that time only 12' north of the star. Planet and star will not be visible when at the nearest approach, but on the evening of the 24th Saturn will be near the star and west of it, while on the evening of the 25th he will have passed the star, and will be found east of it.

The conjunction is interesting, for it is a phenomenon that every observer can see for himself as he watches the apparent approach and recession between a planet and a fixed star. It is the planet that moves, the star remains fixed.

Saturn occupied nearly the same position in the heavens on the 6th of February that he will occupy on the 25th of April, only he was then 8' farther south. On the 6th of February, he was 4' north of the star, and so near that on several successive evenings planet and star seemed to touch each other. The view through an opera glass, when they were separated by only a thread of sky, was very beautiful.

The planets, as seen from the earth, present three different aspects. They have what is called direct motion, when they move eastward, and retrograde motion, when they move westward, and they are sometimes stationary, or seem to be standing still.

Saturn on the 6th of February was retrograding, or moving westward. He continued in this course until the 17th of March, when he was stationary for a few days. He then turned a celestial corner, and has since moved eastward, or in direct motion. On the 25th of April, he will be again directly north of Delta Geminorum, just 8' north of the point he started from seventy-eight days before.

The student who wishes to become familiar with the movements of the planets will find that a careful observation with his own eyes will impress a simple incident like this upon his memory far more powerfully than a hundred descriptions as seen by other eyes.

The conjunction of Saturn and Delta Geminorum proves by actual demonstration that the planets were rightly named "wanderers," for they are always on the move. The observation of this conjunction is easily made. Planet and star may be followed in their course every clear evening for a month to come. The unaided eye may behold the scene ; a marine glass will greatly aid in the observation ; and a good telescope will reveal a spectacle of surpassing beauty. For within its field of vision, the wonder of the system will be seen, encircled by his glowing rings, the picture including several of the Saturnian satellites, while the far away star, Delta Geminorum, will shine, previous to the 25th, on the east, and, after the 25th, on the west of the planet.

THE NUMBER OF STARS IN OUR UNIVERSE.

M. Hermite, a French astronomer, has made some curious mathematical observations concerning the number of the stars. According to his computations, the total number of stars visible to the naked eye of an observer of average visual power does not exceed 6,000. The northern hemisphere contains 2,478, and the southern hemisphere contains 3,307 stars. In order to see this number of stars, the night must be moonless, the sky cloudless, and the atmosphere pure. Here the power of the unaided eye stops. An opera glass will bring out 20,000 ; a small telescope will bring out at least 150,000 ; and the most powerful telescopes that have been constructed will show more than 100,000,000 stars.

It is well known that in order to compare stars with each other, they are divided into classes or magnitudes according to their apparent brightness. There are 20 stars of the first magnitude. In passing from one order of magnitude to the succeeding, it is found that the number of stars follow the law of an increasing geometrical progression, of which the first term is 19 and the ratio 3. There are therefore 57 stars of the second magnitude, 171 stars of the third magnitude, and so on. When the fourteenth magnitude is reached, the number of stars has increased to over 30,000,000. The number of stars really observed corresponds nearly with those found by calculation.

M. Hermite elaborates another law, which is that the total luminous intensity of the different orders of magnitude of the stars follows also an increasing geometrical progression, of which the first term is 19 and the ratio is $\frac{3}{2 \cdot 56}$. Thus it takes 110 stars of the sixth magnitude to equal one of the first, and no less than 202,314 stars of the fourteenth magnitude to equal one of the first.

M. Hermite concludes that the light emitted by all the stars upon the whole surface of the globe is equal to one-tenth of the light of the full moon. According to Sir William Herschel, the light of the full moon is equal to that of 27,408 stars of the first magnitude. The light of all the stars is therefore equal to 2740 8 stars of the first magnitude. Using these data in carrying out the law, the astounding result is reached that the sum of all the stars down to the twentieth and a half magnitude is 66 millions of millions !

THE DESIGNS FOR U. S. WAR VESSELS.

On April 1 there were opened in the office of the Secretary of the Navy the plans submitted by various engineers and constructors for an armored cruiser and for a line of battle ship. The Navy department had for a long period advertised for these plans, offering to pay $15,000 each for such as they might select. This liberal offer secured a competition from foreigners as well as Americans. The following companies and individuals offered plans:

England.—The Thames Iron Ship Building Company, London ; the Barrow Ship Building Company; Mr. Watt, of Birkenhead.

France.—A. H. Grandjean, Marine Engineer, St. Nazaire.

New Zealand.—Capt. N. S. Clayton, Auckland.

United States.—Lieut. W. I. Chambers, United States Navy; Chief Constructor T. D. Wilson, United States Navy (Chief of Bureau of Construction); Constructor S. H. Pook, United States Navy; N. L. Tonns, New York City; F. L. Norton, Washington.

The plans varied in execution as well as design. Some were mere suggestions, while some went into the greatest detail and were accompanied by models. The Thames Iron Ship Building Company propose to give the battle ship a speed of 18 knots with 10,000 horse power, and the cruiser 20 knots with 6,000 horse power. The Navy department plans contemplate a speed of 18 knots for the battle ship with the same horse power. The plans from the department were specially ordered by Secretary Whitney to provide for possible failure to procure plans from outside sources.

The result of the competition as indicated by the plans accepted will be watched for with much interest. It is evident that the new vessels will be fast, a quality that has now become absolutely necessary in war vessels.

The Fastest Boat in the World.

The application of twin screws to torpedo boats is practically a new departure, for although twin screws have been suggested and even used in fast launches capable of carrying a spar torpedo, they have never been adopted or even tried on a large scale in torpedo boats of the first class. The more interest therefore attaches to the trial trip made recently of a twin screw torpedo boat, one of two built for the Italian government by Messrs. Yarrow & Co., of Poplar. This boat has the following dimensions: Length on water line, 140 ft.; beam, extreme, 14 ft.; draft, 5 ft. 4 in.; displacement, 100 tons. Steam is supplied by two locomotive boilers, one forward and one abaft the engine room. Either boiler can supply either engine or both. The screws are driven by two pairs of compound engines, indicating over 1,400 horse power combined. Condensing water is supplied by centrifugal pumping engines, arranged to pump out of any compartment in case of leakage, while ejectors and hand pumps are fitted to each of the main compartments. This boat is fitted with no less than ten water-tight bulkheads, and Yarrow's patent water-tight ashpan arrangement to both boilers, by which the fire is prevented being put out in case of water entering the stokeholes, and the boat can run 50 or 60 knots after the stokehole is flooded, an advantage the importance of which cannot be overestimated. Double steam steering gear is fitted to work either rudder quite independently of the other.

The armament consists of two bow tubes and two at a very small angle with each other on a turntable aft for side discharge simultaneously, to insure at least one torpedo hitting. She also carries two quick firing Nordenfelt guns. Cabins are fitted for the crew forward, petty officers right aft, and a saloon, lavatories, etc., are provided for officers further amidships.

The trial trip took place in the Lower Hope, below Gravesend. The weather was very rough, the number of people on board thirty-three, equipment complete, and load carried 12 tons.

	Steam pressure.	Vacuum.	Revolutions.	Speed.	Mean.	Second mean.
				knots.	knots.	knots.
1	135	27	365	22 641		
2	129	27	364	27·272	24·956	
3	128	26½	365	22·360	24·816	24·886
4	130	26½	370	27·692	25·026	24·921
5	131	26½	372	22·360	25·026	25·026
6	132	27	364	27·692	25·026	25·026
Means	130	26¾	366	—	—	24·964

This is practically a speed of 25 knots or 28 miles per hour. *This is the greatest speed ever attained through the water by any ship or boat*, and is a wonderful performance. We shall have more to say concerning this Italian torpedo boat. Meanwhile we may point out that our own government would use only a necessary precaution if they took care to provide this country with an adequate number of similar boats.—*The Engineer.*

Phosphorescent Photography.

At a recent meeting of the Photographic Society of Philadelphia, Mr. Frederick E. Ives made a short address on the subject of "Photographing by the Aid of the Phosphorescent Tablet." He said :

Photography by the aid of the phosphorescent tablet is not a new discovery, having been known since 1880. It is not even a practically useful method, and is interesting only from a scientific point of view. My own experiments with the method having resulted in the discovery of certain facts not previously known, I have been persuaded to show the results, and make some remarks concerning them.

The facts, already well known, are that Balmain's phosphorescent paint, which probably consists chiefly of sulphide of calcium in a suitable vehicle, becomes luminous when exposed to light, and the light emitted acts powerfully on photographic sensitive plates ; also that heat releases phosphorescent energy. Solarized phosphorescent tablets have been used as a source of light for contact printing in the dark room ; and negatives have been made by exposing the tablet in a camera, and then making a contact exposure on a photographic sensitive plate in the dark room. Such a photograph I now show. It has a somewhat granular appearance, due to the coarseness of the particles of sulphide of calcium, and although the lines are partly sharp, they appear surrounded by a sort of halo. The editor of the *British Journal of Photography*, in a recent editorial, advanced the theory that this effect was due to a spreading of the phosphorescence, and that it would be impossible to obtain a sharp camera photograph by the aid of the phosphorescent tablet. My belief is that the phosphorescence does not spread, and that the effect is due merely to the fact that the luminosity of the phosphorescent coating extends to considerable depth, and the light from the lower part of the layer acts diffusely, because it is radiated from a point at some distance from the surface of the photographic sensitive plate.

To test this, I exposed a tablet in the sunlight until fully solarized, then removed it to the dark room, and placed it in contact with another tablet, under pressure. It was impossible to discover any communication of phosphorescence by contact, and if any occurs it is insignificant. I also observed that prints and camera impressions on my tablets appear perfectly sharp to the eye, and found that they could be reproduced sharply by photographing in the camera. I therefore conclude that it is possible to make sharp camera photographs by the aid of the phosphorescent tablet, but that the method has no value, because it is always easier and better to make photographs in the usual way.

It has been suggested that the tablet might offer some advantage in the reproduction of colored objects. It is true that the color sensitiveness is not the same as that of silver bromide, but the difference has been found to be altogether in favor of the silver bromide.

The second known fact that I mentioned is that heat releases (exhausts) phosphorescence. It does not appear to have occurred to any one that this might be made a means of producing camera pictures by the action of the heat, until I discovered that the obscure heat rays of the lime light spectrum produced a strong impression on a solarized phosphorescent tablet. I succeeded in producing heat pictures of objects under certain conditions, which are described in a communication to the Franklin Institute and published in the Institute journal for this month.

Mr. Ives showed on the screen several photographs, among which was one showing some buildings, made by the use of a phosphorescent tablet in the camera, and another in which a metallic object had been photographed by the action of reflected heat rays on the tablet in the camera.

Lecture on the Pneumatic Dynamite Gun.

A paper on the above subject was read by Lieut. Edmund L. Zalinski before the Military Service Institute, in the upper room of the Army Museum on Governor's Island. The meeting was called to order by Major-General Schofield. Quite a distinguished audience was present, including General Abbot, Lorettus Metcalfe, of the *Forum*, and other military and civil notabilities. The points treated of by the lecturer were in the main the same that have been already presented in our columns.* The benefit of the high trajectory was well brought out. For use on ships this was shown to be an actual benefit, as the range of shot would be less affected by the motions of the vessel in general proportion to the height of the trajectory. The practicability in an emergency of arming ferryboats with these guns was touched upon.

Lieut. Zalinski, in concluding, recited the names of those who had been instrumental in perfecting the weapon, claiming as his portion the system of electric firing. A discussion followed, and the proceedings closed with a short address of commendation and appreciation from General Schofield, after which an adjournment was taken. Sectional drawings of the new dynamite cruiser, an 8 inch shell, and the wet and dry batteries, and safety cut-offs, were exhibited.

Asbestos Paper.

Mr. Ladewig has devised a process of manufacturing from asbestos fiber a pulp and a paper that resist the action of fire and water, that absorb no moisture, and the former of which (the pulp) may be used as a stuffing and for the joints of engines.

The process of manufacture consists in mixing about 25 per cent of asbestos fiber with about from 25 to 35 per cent of powdered sulphate of alumina. This mixture is moistened with an aqueous solution of chloride of zinc. The mixture is washed with water, and then treated with a solution composed of 1 part of resin soap and 8 or 10 parts of water mixed with an equal bulk of sulphate of alumina, which should be as pure as possible. The mixture thus obtained should have a slightly pulpy consistency. Finally, there is added to it 35 per cent of powdered asbestos and 5 to 8 per cent of white barytes. This pulp is treated with water in an ordinary paper machine and worked just like paper pulp.

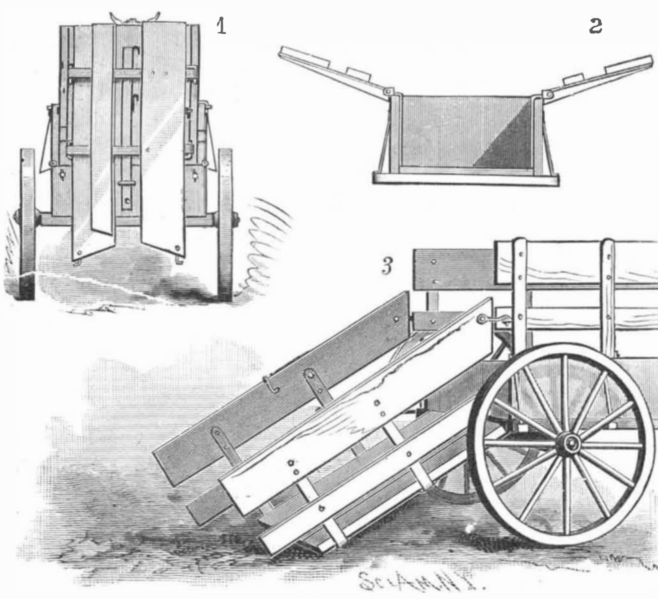
In order to manufacture from it a solid cardboard, proof against fire and water, and capable of serving as a roofing material for light structures, sheets of common cardboard, tarred or otherwise prepared, are covered with the pulp. The application is made in a paper machine, the pulp being allowed to flow over the cardboard. Among other uses, the asbestos paper has been recommended for the manufacture of cigarettes.—*L'Industrie Moderne.*

THE Senate of Pennsylvania have passed a bill providing for the infliction of capital punishment by electricity. If we are not mistaken, it was the SCIENTIFIC AMERICAN that first advanced the idea of applying electricity for executions, and it was not long after our publication that two or more patents were issued for chairs provided with wires for the purpose.

* See SCIENTIFIC AMERICAN, April 9, 1887, p. 225 ; and October 31, 1885, p. 271.

IMPROVED WAGON RACK.

The accompanying engraving represents a rack that can be readily transformed for use as a stock rack or as a hay rack as may be required. To the sides of an ordinary farm wagon are hinged arms provided with boards to form the sides of the rack. The hinges are so formed that when the rack sides are raised to a vertical position, they will be directly above the side boards of the wagon. The inner ends of the arms are beveled to rest against the wagon side boards when the rack sides have been lowered to position to form a hay rack, as shown in Fig. 2. To the forward end of the bottom of the wagon is attached a tapered ladder. When the rack is to be used for transporting hogs or other stock, the sides are turned up to a vertical position, and are locked by hooks to supplementary gates attached to the forward and rear end gates by cleats passing through staples. Held to the rear gate by a staple and bolt is a bar, Fig. 1, at the free end of which are hooks, which serve to retain the pole that passes over a load of hay from the ladder in front. To the cleats of the rear supplementary gate are hinged straps connected by boards forming sides to the gate. Fig. 3 shows the gates and their sides arranged as a chute for loading and unloading stock. When not used as a chute, the side boards of the gate are folded up against the gates, as shown in the rear elevation, Fig. 1.

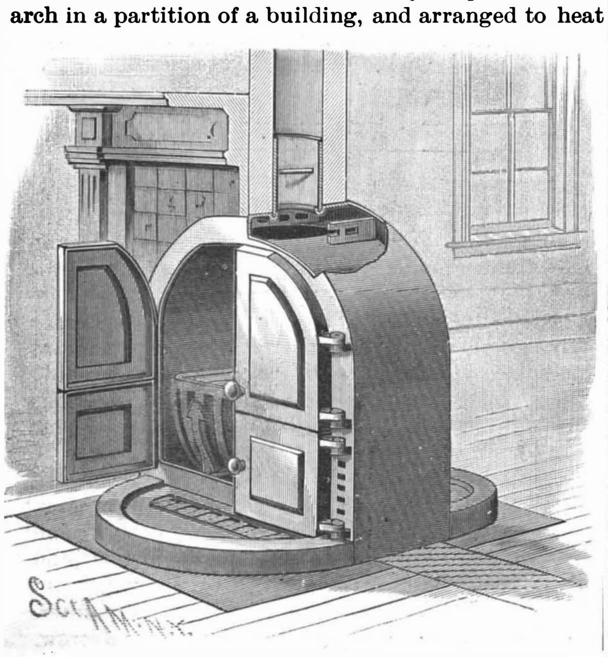


EDWARDS' IMPROVED WAGON RACK.

This invention has been patented by Mr. T. V. Edwards, of Monmouth, Illinois.

IMPROVED STOVE.

The stove herewith illustrated may be placed in an arch in a partition of a building, and arranged to heat two rooms. The stove is rectangular in form, with an arched top to receive the stovepipe connected with the flue. The side and top walls are made double, forming air spaces for the protection of the partition in which the stove is placed. The air spaces are provided with damper openings near their lower ends, and also with openings discharging into the stove top near the flue opening.



BIRNBAUM'S IMPROVED STOVE.

The back of the stove is offset to increase the interior, and is closed tightly, so that neither ashes, smoke, nor gas can escape from that side. The front is provided with two pairs of doors. The two lower ones inclose the fire and grate, and the upper ones inclose the combustion chamber. Below the line of the cross bar upon which the lower doors close is the ash pit, above which are two bars whose ends extend downwardly at right angles, and are received in sockets formed on opposite sides of the stove. When the stove contains a wood fire, the wood rests upon these bars; and when coal is used, a basket grate is supported by the bars. The bars are apertured to receive ornamental upright braces, which hold the grate in position. The ash pit extends beyond the front of the stove, and is provided with a removable plate, having openings which may be closed by a damper. The stove is placed on a brick foundation, and the front of the ash pit is made hollow for containing air, to prevent it from becoming overheated. A casing, similar in form to the projecting portion of the ash pit, is fitted to the back of the stove, to improve its appearance and serve as a foot rest.

The stove is placed in a partition having a flue for carrying away the products of combustion. In the flue is placed a short length of stovepipe, provided with a cross bar, by which it may be moved up and down in the flue. In the flattened top of the stove is a groove surrounding the smoke discharge opening, for receiving the edge of the pipe. The pipe being pushed up in the flue by means of the cross bar, the stove may be put in place and the pipe pulled into the groove by reaching up through the stove and grasping the cross bar. The fire is controlled by the damper in the ash pit cover when the doors are closed, and may be further controlled by opening or closing the doors.

This invention has been patented by Mrs. M. E. Birnbaum, of Santa Barbara, Cal.

Metallic Book Covers.

Another application has been found for metal, which is now being substituted for cardboard in bookbinding. This novelty is known as the "British Pellisfort" binding, and it consists in the use of thin sheet metal for covers. The metal is specially prepared, and the cover may be bent and straightened again without perceptible damage. It may, in fact, be safely subjected to such treatment as would destroy ordinary covers. The metal is, of course, covered with the leather usually employed in bookbinding, and the finished book presents no difference in appearance except in the greater thinness of the cover. It is well adapted for Bibles, church services, and other similar publications.

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court.—District of Massachusetts.

ROYER *et al. vs.* COUPE.—PATENT MACHINE FOR TREATING HIDES.

Carpenter, J.:

Action at law for the infringement of letters patent No. 77,920, issued to the plaintiffs, Herman Royer and Louis Royer, May 12, 1868, for a machine for treating hides.

In action for infringement of letters patent No. 77,920, issued to Herman and Louis Royer, May 12, 1868, for a machine for treating hides, plaintiffs' machine softened the hide by fastening it to a vertical shaft revolving in a crib, in which the hide was revolved under the pressure of a weight in the upper part of the crib, through which the shaft passed. Defendant's machine softened hides in the same way, except that his shaft was horizontal, and the pressure on the hides was applied through the head of the crib by screws. *Held* an infringement, the principle and method of the plaintiffs being used in the design of the defendant.

If a patent is issued to two persons as inventors, when in fact it was invented by only one, the patent is void.

Where an improvement is made and patented in a patented machine, the first patentee cannot use the improved machine without the consent of the second, and the second cannot use his machine without the consent of the first.

If the first patentee's machine is not operative and the second patentee's is operative, the first patentee must be confined to his own particular application of his principle, and there is no infringement by the second patentee.

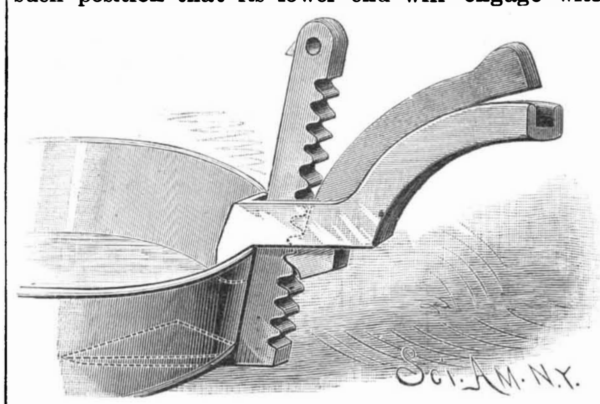
In determining the question whether a patent is operative, the workings, not of a machine made as a literal copy of the drawings of the patent, but of one made with the mechanical devices which will tend to make a machine practical and operative, and which are within the duty of the mechanic, are to be considered.

The value of an invention to the party using it is competent evidence on the question of damages for the infringement of a patent.

WHAT will remove grease spots from clothing in the best manner, is a frequent inquiry. There is probably nothing better than equal parts of strong ammonia water, ether, and alcohol. Pass a piece of blotting paper under the grease spot, moisten a sponge first with water to render it "greedy," then with the mixture, and rub with it the spot. In a moment it is dissolved, saponified, and absorbed by the sponge and blotter.

IMPROVED PAN LIFTER.

This lifter is composed of three parts—the standard, grasping lever, and binding lever. The standard is serrated at its rear edge, and is formed with a foot, indicated by the dotted lines in the drawing. The grasping lever has a hook at its forward end, and is mortised to pass freely over the standard, and also to receive the binding lever, which is pivoted in the mortise in such position that its lower end will engage with the teeth of the standard. To apply the lifter, the foot is shoved under the bottom of the pan and the levers are lowered until the hook is fairly over the edge of the pan. The handle portions of the levers are then grasped and brought together. This movement first draws the hook against the edge of the pan, which is grasped between the hook and standard, and then the lower end of the binding lever engages with the teeth of the standard, and firmly locks the device to the pan. The upper surface of the grasping lever is, by preference, channeled to receive the other when the two are brought together. This simple and convenient device may be applied to any pan, whether it have a wide or a narrow rim.

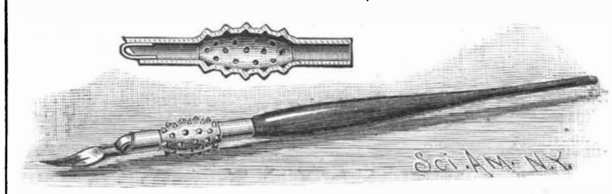


GERMOND'S IMPROVED PAN LIFTER.

This invention has been patented by Mr. Gilbert A. Germond, whose address is Station R, New York City.

IMPROVED PEN HOLDER TIP.

The middle portion of this tip is of greater exterior diameter than either of the ends, into one of which the handle fits, while the other is formed to receive and carry the pen. The enlarged middle portion is in the form of a gradual swell, as shown in the accompanying figures. This shape is most favorable to the placing of the thumb and finger on it, and insures a much firmer grasp than when the middle and end parts are of like diameter. The enlarged part also prevents the pen end of the tip from coming in contact with and inking the surface on which the holder may be placed, and it is formed with numerous teats or protuberances, which further facilitate the grip or hold upon it, and by permitting the air to circulate between the tip and fingers prevent heating when the tip is in use.

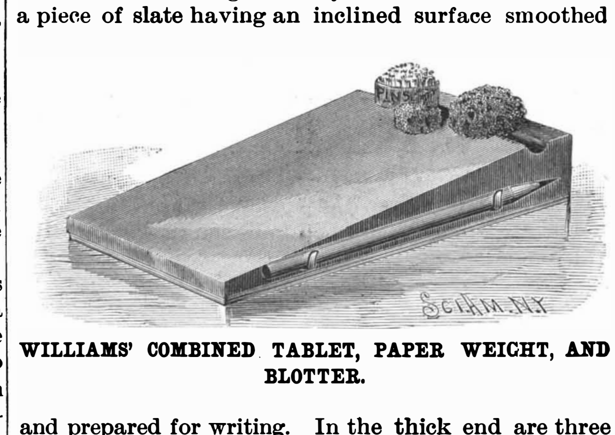


HEWITT'S IMPROVED PEN HOLDER TIP.

This invention has been patented by Mr. Hezekiah Hewitt, of Birmingham, England.

COMBINED TABLET, PAPER WEIGHT, AND BLOTTER.

The block forming the body of the tablet is made of a piece of slate having an inclined surface smoothed and prepared for writing. In the thick end are three cavities, one for a roll of pins, one for a dry and one for a moistened sponge. Hooks project from the side of the tablet, for supporting a pencil. The damp sponge is for moistening the fingers for handling bills and papers, and the other is for use in erasing marks from the slate, it being moistened by being applied to the wet sponge. One or more sheets of blotting paper are secured to the under surface of the tablet. This tablet is designed to be used upon desks in the counting room for the purpose of making temporary memoranda and for supporting a sponge and a quantity of pins in convenient position for use.

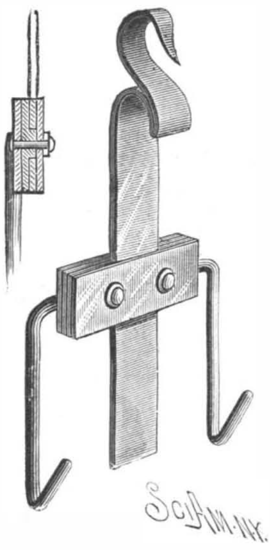


WILLIAMS' COMBINED TABLET, PAPER WEIGHT, AND BLOTTER.

This invention has been patented by Mr. John M. Williams, of Hazleton, Pa.

CONNECTION HANGER FOR ELECTROTYPING APPARATUS.

The body of the hanger is formed of a broad, flat strip of suitable conducting material, as copper, bent to form a hook at its upper end, which is received on a rod extending across the top of the depositing vat or trough of the electrotyping apparatus. The middle part of the strip is enlarged to form a rectangular plate, at the back of which is secured a similar plate carrying the sustaining hooks. These two plates are separated by an insulating plate, and the outer face of the conducting plate is also insulated by a plate, as shown in the sectional view. The four plates are held together by rivets, so insulated as not to make connection between the conducting and sustaining plates. The sustaining plate is provided with hooked arms, on which the moulding case is supported.



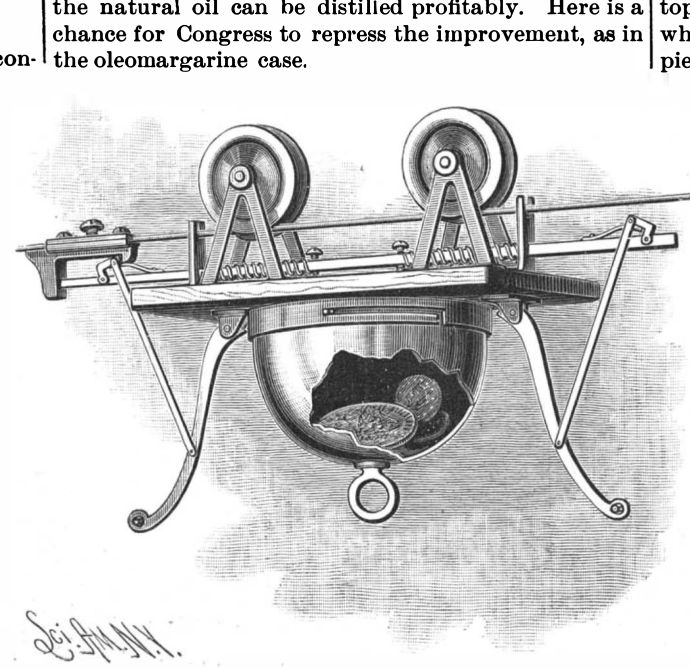
Upon the upper supporting hook is sweated or otherwise secured a second hook, having a sharpened point, so that when the hanger with the attached mould is removed from the vat or restored thereto, the time card on the sharp pointed hook will not be displaced. This construction of the hanger does away with the plating of the moulding case and the forming of electrical connections between the conducting and sustaining hooks, and provides means for the convenient handling of the mould.

This invention has been patented by Mr. Otto S. Fertig, of 40 King Street, New York City.

IMPROVED CASH CARRIER.

The cash carrier herewith shown is simple in construction and practical in operation, and requires no extra motion to disconnect it from the stop blocks, while the car, owing to suitable buffers, can receive no injury from coming in contact with the stop blocks. To the upper surface of the car are secured uprights, in which are journaled the axles of grooved wheels running upon the overhead wire or track. In other uprights is held a rod on which are placed two coiled springs, so arranged that the rod acts as a double buffer to the carrier, each of its ends being adapted to strike a stop block, two of which are attached to the wire, one at each end. Near each end of the bar is a pawl, acted upon by a spring which lifts its free end so it will automatically engage with a lip formed on the stop block for holding the car stationary when it reaches either end of its trip. The pawls are disconnected and the car started by means of levers pivoted to the frame and connected with the pawls. When either of the levers is grasped for shoving the car along upon the wire, a slight downward pressure upon it will free the pawl from the lip, thus freeing the car, which, by a slight forward movement of the hand, may be caused to travel the wire to its opposite destination. The money is carried in a cup attached by bayonet connections to a rim secured to the under surface of the frame.

This invention has been patented by Mr. Joseph Starr, of 26 State Street, New London, Conn., who will furnish any further information.



STARR'S IMPROVED CASH CARRIER.

LEWIS TENT POLE AND VENTILATOR.

Those who have used tents have had a full sense of the troubles which this invention is designed to overcome. If the halyards of a tent slacken, or if the canvas becomes loose, the tightening and readjusting have hitherto been done from the outside. In stormy weather, or on a cold rainy night, it is far from pleasant to huddle on some wraps and spend a long five minutes tying and untying ropes that seem never to adjust themselves to the requirements. The tent pole shown in our cut furnishes the means of tightening up the tent from the interior. The upper section of the pole telescopes into the lower, carries a screw, and by means of a nut bearing on the top of the lower section of the pole, it can be raised or lowered as required. A jointed handle is pivoted to the nut, and is held by a spring in a position at right angles to the pole, or parallel with it. This keeps it stationary in either the working position or out of the way, as desired. Another invention in the same line is also presented in the illustration. It consists of two movable hoods that can be opened or closed from the interior of the tent. The inner one, by an endless cord, can be opened or shut or kept partially open as desired, while the exterior hood acts as an awning to exclude the sun or rain. These improvements have been patented by Mr. Patrick Lewis. Further particulars can be had from Mr. Geo. Irvine, of 92 St. Peter Street, Quebec, Canada.

LEWIS' TENT POLE AND VENTILATOR.

Practical Method of Thawing Earth.

It is often necessary to make excavations for pipes in very cold weather, under which conditions the operation is difficult. The trouble due to frost can only be remedied by thawing out the surface.

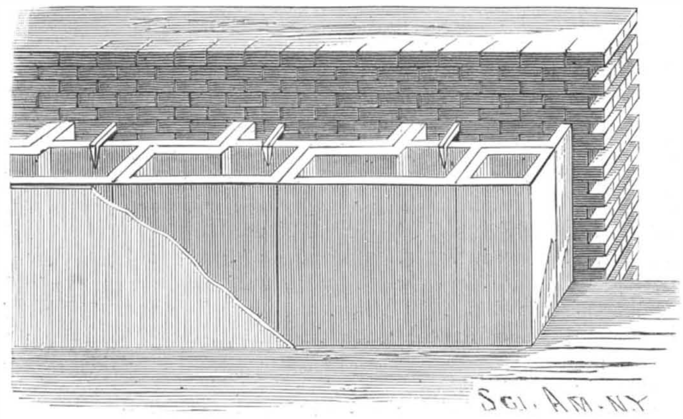
The *Elettricita* says that quicklime has been tried with success. The surface where the excavation is to begin is covered with alternate layers of lime and snow. The lime becomes slaked, and heats the soil so effectually that after ten or fifteen hours it can be dug up with the greatest ease, even where the cold is excessive. It goes without saying that where there is no snow, water can be used. This makes the process a little more complicated, but is just as efficacious.

As in the generality of cases urgency exists, the digging up of pipes being necessitated by some case of repairs, this method is restricted in its application to those cases in which the delay of a day or a night is not inadmissible.

IN the opinion of the editor of the *American Druggist*, the supply of the natural oil of wintergreen or birch will soon cease to be of any commercial importance, since the artificial product (salicylate of methyl), to which reference was made recently in these columns, is now being prepared of such good and uniform quality that it will undoubtedly replace the natural oil. Moreover, the artificial article can be produced at a cost below that at which the natural oil can be distilled profitably. Here is a chance for Congress to repress the improvement, as in the oleomargarine case.

DOUBLE AIR CHAMBER FURRING TILE.

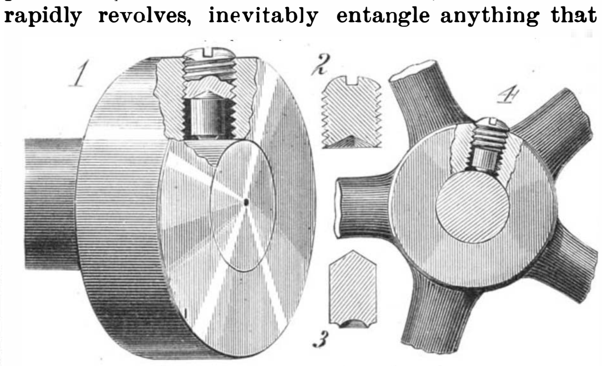
The accompanying engraving represents a double air chamber furring tile which has been recently patented by Mr. Thomas W. Snell, of 174 Howe Street, Chicago, Ill. For convenience in manufacturing, two tiles are formed together and are then separated after baking, the finished tile being of the shape clearly shown in the engraving. The flanged sides of the tiles are placed against the walls of the building, the tiles of each tier being fastened to the wall by hooks driven into the joints between the layers of brick. The tiles in each tier are so arranged as to form zigzag vertical joints. It will be observed that the tiles interlock with one another. This gives the furring great strength, while the peculiar form of the tile provides double air spaces, which effectually exclude all dampness. The outer surface of the tiles is plastered. This improved tile may be made of any suitable material, such as burnt clay, cement, or plaster of Paris.



SNELL'S DOUBLE AIR CHAMBER FURRING TILE.

SAFETY SET SCREW FOR COLLARS AND PULLEYS.

The ordinary mode of fastening collars and small sized pulleys on rotating shafts has been by means of one or a number of set screws—although it is well known that this is a most dangerous device, as the protruding head of the set screw will, as the collar rapidly revolves, inevitably entangle anything that comes in contact with it, and carry it around the shaft, and thus very often break belts, and, much worse, often endanger human life. It therefore seems strange that hardly any attempt in the way of invention has been made to obviate that dangerous contrivance; certainly no attempt has been made at all to substitute for it a safe method of fastening collars or hubs to shafts. The annexed illustrations show such a substitute, and its adaptation on a collar and on a hub of a pulley.



ROCHOW'S SAFETY SET SCREW FOR COLLARS AND PULLEYS.

The set screw heretofore used is replaced by two pieces, a short screw, Fig. 2, flush with the circumference of the collar or hub, and which is slotted on top, so that it can be set up by a screw driver, and which is countersunk on the inside where the second piece, Fig. 3, a small steel plug, fits into the countersink, and is forced against the shaft by the screw. The surface of the steel plug is serrated on the side toward the shaft, and the collar is made so that there is a clearance all around the steel plug. When this screw is set up snugly against this steel plug, so that the serrated surface of the latter is somewhat embedded into the shaft, then the plug acts like a pawl and toggle in any direction on which a strain might be brought against the collar or hub, and the greater the strain, the more will the plug embed itself in the shaft, and the tighter it will hold the object to the shaft. By means of this simple device, a collar or hub can be fastened to a shaft much firmer than by a mere set screw, and there being no projection beyond the periphery, all danger is obviated.

This invention has been patented by Mr. F. Rochow, of Bridge and Plymouth Streets, Brooklyn, N. Y.

FARMERS who raise turkeys in Lehigh County, Pa., drive them to market as they would sheep. Sometimes flocks of two hundred are thus driven along the public roads.

Natural History Notes.

Raising Diatoms from Spores.—Owing to the very peculiar beauty and variety of their forms and the external markings of their indestructible siliceous skeletons, no organisms have received so much attention from microscopists as diatoms. "Appearing everywhere with the first-born of life, and wherever matter is found in a condition fit for their development and nourishment, these marvelous, indestructible organisms have been preserved and brought down to us, in forms unchanged, from the remotest periods of our globe's history." Their claims to a place among animals was once very warmly urged by naturalists, but the discovery, by Mr. Ralfs, of the formation of spores by conjugation in several of the genera effectually put an end to the controversy, and decided their right to a place in the vegetable kingdom. Some further light has recently been thrown on the subject of the development of these algæ, by Dr. Samuel Lockwood, who, in a paper in the December number of the *Journal of the New York Microscopical Society*, gives an interesting account of a series of experiments, extending over several years, in raising several species in his laboratory. The following is a *resume* of these experiments, in the author's own words:

"1. My experiment of December, 1882, the results of which I have confirmed by so many observations made since, demonstrates that diatoms originate in spores, or seed-like bodies.

2. These spores are exceedingly minute, passing easily through filter paper.

3. They are probably resting spores, not motile, and may be held in suspension awhile like the mineral matter in turbid water.

4. The viability of these spores is remarkable. The diatoms raised in the first series of experiments were from spores whose life force had lain dormant in total darkness for thirteen or fourteen years; those in the second series, for sixteen years.

5. The viability of some genera is greater than that of others. This is notable of *Navicula* in these experiments, and is consonant with the numerical lead of this genus in forms or so-called species.

6. Owing to the environment becoming abnormal, development may be rapid and erratic to a surprising degree, but upon aberrant and asymmetrical lines. Suppressed at some points, the life energy is precociously active at others.

7. Diatoms have embryonal stages or forms, with silicate fronds.

8. As to kind and quantity, the crops are capricious, and vary without apparent reasons.

9. As to the parentage or begetters of the spores in my experiments: They were not generated in the vessel which contained the water, but were begotten of sporangial mother cells in [Raritan] Bay."

Effect of the Electric Light upon Plants.—A citizen of Davenport, Iowa, whose garden is situated at about one hundred feet from an electric light tower, has remarked that his lilies close at sunset, but open again a few minutes after the arc lamps have been lighted. It has been observed at Detroit, too, that the foliage of the trees exposed to the rays of the electric light is much more luxuriant than that of such trees as are not.

Storms Foretold by Insects.—A French exchange states that upon the approach of a storm, the summit of the Puy-de-Dome is visited in succession by hosts of gnats, winged ants, and swallows. It is well known that the latter are attracted by the ants, but whence the ants and knats come is a mystery. The insects often arrive in such numbers as to cover the floors of the observatory, where they are crushed by the million.

The Botanic Gardens of the World.—According to a report of the Montreal Horticultural Society, there are 197 botanical gardens in the entire world, and they are thus distributed: France and her colonies, 25; England and Ireland, 12; the English colonies, 27; Germany, 34; Italy, 23; Russia and Siberia, 17; Austria and Hungary, 13; Scandinavia, 7; Belgium, and Holland and colonies, Spain and colonies, and the United States, 5 each; Portugal and Switzerland, 3 each; Denmark and Roumania, 2 each; Brazil, Chili, Ecuador, Egypt, Greece, Guatemala, Japan, Peru, and Servia, 1 each. The list may be completed by mentioning the gardens of Geneva and Louvain, and a few that have recently been organized in English India. At least half of the gardens mentioned above are kept up by the government, 18 per cent by universities, sometimes in conjunction with the general or city government, 11 per cent by cities alone, and 5 per cent by private donations. Out of the same number 94 per cent are always open to the public, 70 per cent are open to visitors on Sunday only, and 73 per cent publish reports, or contribute in some such way to scientific research.

A Living Pop Gun.—In the Eastern seas, from Ceylon to Japan, there abounds a little fish, belonging to the genus *Chætodon*, which secures its prey by means of an instrument like the blow-pipe used by boys for projecting peas and putty. The nose of this fish is a sort of beak, through which it has the power of propelling a drop of water with force enough to bring down a fly. Its aim is very accurate, and it rarely misses its object. The unsuspecting victim sits on a weed or tuft of grass near the water; the fish cautiously approaches, stealthily projects its tube from the water, takes a sure aim, and lets fly, when down drops the insect, to be swallowed by its captor.

Treatment of Silver Ores in Mexico.

Consul Winslow, of Guerrero, says that in the neighborhood of all the mines in Mexico there are *haciendas de beneficio*, or works for extracting the silver from the ore. These buildings are generally about 300 feet long, and at the back there is a courtyard. In front there is generally a large doorway for entrance, where nobody is allowed to enter without previous permission. The *hacienda* is managed by an administrator, who has his officials and clerks, and directs the establishment. The peons, or workmen, gain from three shillings to four shillings a day, and are paid off at the end of each week. The ore as it is brought from the mine is in large pieces, and these are piled up in the court yard in a huge pile. They are in the first place put into an inclosed box, and pounded to pieces by immense wooden pounders, armed at the end with iron pestles, which are lifted up by arms connected with an axle, which is turned by mules. The end of these arms fit into a notch in the pestles, and lift them up a certain distance, and then the end of the arm slips out of the notch, and the iron pestle falls down with an immense force upon the mineral, and crushes it into small pieces. These fall down upon a sieve made of hide, and the smaller pieces fall down through the holes in the sieve, and the larger pieces are thrown back under the pestles to be again crushed. There are several of these pestles in a straight line, connected with the same axle, and they are lifted up alternately. After the ore is pounded to pieces in the mortars, it passes to the mills, which consist of a round vat placed on a level with the floor, where the metal is ground up into a fine mud, water being added, by means of three heavy and hard granite stones, of an oblong shape, which are tied to the arms, connected with a revolving axle turned by a mule, which walks round in a circle blindfolded.

Into holes made in the stones sticks are introduced, and these are connected by means of ropes or chains to the revolving arms. There are several of these circular vats, all situated in a line in a long room, each worked by a mule blindfolded. These are called *tahones*, and the crest pole in the middle the *peon*, with two arms of wood, from which are suspended the heavy stones, called *metapiles* or crushers. From here the ore, which has the appearance of mud, is thrown out into the courtyard, which has a floor well made of hard cement or stone, and here are added quicksilver and salt in a liquid state, or *caldo* as it is called. It is thus left in the open air, exposed to the heat of the sun, some twenty or thirty days, and is stirred up every day or two by the feet of men and horses, who walk round in a circle until the quicksilver and the salt are well incorporated with the ore. When this process is completed, the mud thus washed is called *torta de lama*.

After the ore is thus worked or brought to a proper state, it goes to the *lavadero*, or washing-place, which is a round vat made of wood and stone, where the silver is separated from the earth, and here is where the *tortas de lama* are taken from the yard, and here remains, after the mud is washed out, what is called the *plata pina*, or amalgamated silver. This amalgam is then put into stout canvas bags, and submitted to a heavy pressure to get rid of the mercury, and afterward it goes to the furnace, where the silver is purified of all foreign substances. There is an additional process which is pursued with certain kinds of ores.

After the mineral has been exposed to the sun in the *patio*, or courtyard, it is transferred to the *planillo*, which is an inclined plane in the open air, having a solid stone floor about sixty feet long and twenty feet wide. At the foot of this sit a number of nearly naked men, who are engaged in throwing water gradually on the mass of mud by means of pieces of ox horn, so that the mud flows off, and runs outside the yard into a ditch, and the silver, with some mud, is left at the foot of the inclined plane. After this process, the greater part of the mud has been removed, and only a small portion remains, which contains the silver. This mud is then taken to a room on the second floor, where it is placed in the *criso*, a large round iron boiler, with fire underneath; water is added, and it is stirred up by means of revolving arms worked by a mule, and the remaining mud flows off, only a small portion remaining. The rest of the process consists in removing the remaining substance to the amalgamating room, where quicksilver is added, which unites with the silver in the mud, and this is further washed, and only the quicksilver is left united with the silver. This is further purified in the furnace, and the silver runs off into moulds, and is then sent to the mint at San Luis Potosi to be coined.

There are different kinds of ores—one which is merely exposed to the fire of a furnace, and this is called *fundicion*, and another of the *patio* or yard. One kind of ore goes to the *patio*, and from there to the *lavadero*, and another goes to the *planillo*, and from there to the *criso*. The white and green silvers are put through the process of the *patio* and the *criso*; the bronzes, and those containing lead, and those mixed with other minerals, are extracted by the *patio* and the furnace. The processes used for extracting the silver are very primitive. From three hundred pounds of crude metal only three to eight ounces are extracted. Some of the richer ores, after being ground up, are mixed as before with mercury and salt, and then made into *tortas* or piles, some six feet in diameter, and an Indian, bare legged, commences in the middle and walks round regularly, placing one foot before the other by a peculiar movement, and leaves not a single particle unstamped, and this is kept up all day, the object being to unite the crude mercury with the silver. These men are paid at the rate of about one shilling and sixpence a day.

There are three different kinds of silver ore extracted from the mines, according to the description of the metal with which they are combined, although there are other varieties. There is the *plata blanca*, or white silver, which is the purest and rarest. In this variety the silver can be seen resting on the surface of the stone. There is also the *plata verde*, or green silver, and in this variety the silver is united with copper, and the veins of blue and green in the ore are the silver with the copper. *Las bronces* contain silver, but in a less quantity, united with iron which looks like brass or gold. *Plomosas*, where the silver is united with lead, is frequently met with at the mines situated in Nuevo Leon, such as Ballecilla, Cerralvo, and Villaldama. All the different kinds of silver are called *azogues*, or quicksilvers, and there are also *caliches*, or chalks, which are rich in silver and very common in places.

Metric System.

The following lists, prepared by Mr. James Jackson, archivist of the Geographical Society of Paris, give the present status of the metric system:

COUNTRIES IN WHICH THE SYSTEM IS OBLIGATORY BY LAW.

	Population.
Argentine Republic	2,830,000
Austria and Hungary	37,786,346
Belgium	5,520,009
Bolivia	1,957,352
Brazil	9,883,622
Chili	2,199,180
Colombia	4,000,000
Denmark	1,969,039
Ecuador	946.033
France and colonies	46,843,000
Germany	45,234,061
Greece	1,979.303
Italy	28,459,451
Mexico	10,046,872
Netherlands	4,172,971
Norway	1,806,900
Paraguay	346,048
Peru	2,699,945
Portugal	4,160,315
Roumania	5,073,000
Spain	16,634,345
Sweden	4,579,115
Switzerland	2,846,102
	241,973,011

COUNTRIES IN WHICH THE SYSTEM IS OPTIONAL BY LAW.

	Population.
Dominion of Canada	4,324,810
Great Britain and Ireland	35,241,482
Persia	7,653,600
United States	50,419,933
	97,639,825

COUNTRIES IN WHICH THE SYSTEM IS OFTEN USED WITHOUT HAVING LEGAL VALUE.

	Population.
Egypt	6,820,000
English India	198,755,993
Russia	100,372,553
Turkey	24,804,350
Uruguay	438,245
Venezuela	2,075,245
	333,266,386

—*La Nature.*

Gas Motor Patents.

The Gas-motoren-fabrik Deutz, of Deutz, Germany, who own the "Otto" patents in Germany, and attracted of late attention by the large sizes of Otto engines furnished to city water works and electric light stations, have just obtained a decision in their favor in their suit against Moritz Hille, of Dresden, a manufacturer, and several of his clients and users of infringing engines. The decision establishes the infringement by the defendants, and orders them to discontinue the manufacture and use of the machines; also to account for damages. The Hille engine used the well-known Otto four-stroke cycle, and it is against its use that also other suits still pending against Korting Bros. and Buss, Sombart & Co. are directed. In these cases a decision may soon be expected.

Correspondence.

Assimilating Oil through the Pores.

To the Editor of the Scientific American:

In your issue of March 26 is advice to one who wishes to gain in fat and strength. Let him take a warm bath, thoroughly "opening" his skin, then rub dry with warm, rough towels in a heated room, and when actually dry, let him rub in, thoroughly, any pure oil—cod liver preferably, but olive will do—all over his body. He will find that thus ten times more will become assimilated than his weak stomach can possibly digest. Give the stomach rest and a chance to recuperate, while letting the skin do its work. I. C. HOFFMAN.

Jefferson, Wis., March 28, 1887.

Change of Gauge on the Dayton and Ironton Railway.

To the Editor of the Scientific American:

For some months past, since the C., H. & D. R.R. gained control of the Dayton & Ironton Railway, formerly a part of the Toledo, Cincinnati & St. Louis narrow gauge, preparations have been in progress for changing from narrow to standard gauge.

The road runs from Dayton, O., through Xenia, Washington C. H., and Chillicothe, tapping some of the finest farming region in the State, to Coalton, Wellston, and Ironton, making a mileage of 167 miles to be changed, and giving a new outlet to the coal and iron regions of Jackson and Lawrence counties.

The road has long been an eyesore to the country through which it passes, but will now be a great aid in developing in it. The locomotives were busy hauling all the narrow gauge cars to the Dayton end of the road, the last train passing over the road Saturday morning, April 2.

Immediately on the passing of this train, the section men, under orders, commenced the work of changing the railway and road crossings, and spreading out stringers on the bridges, thus making everything ready for the change of gauge.

Early Sunday morning, April 3, the work of changing the gauge was commenced, with a large force of men, many of whom were borrowed from other roads.

The spikes for the outside of new gauge were driven in every third or fourth tie, and spikes were distributed along the roadbed for the inside.

About every other spike on the old gauge was drawn and the others loosened.

When the change was in progress, one gang of men pulled the outside spikes and another gang threw the rails out to new spikes, while still another gang put in the inside spikes.

The change occupied on an average about six hours for a section.

On Sunday night the first standard gauge train was run over the road, and on Monday morning the regular trains were started.

A force of hands will be kept at work putting the road in standard shape.

Steel rails are laid to Washington C. H., a distance of forty-seven miles, and the steel for the remainder will be laid at once.

The road when completed will be a valuable acquisition to the C., H. & D. management.

C. E. FOWLER.

Chillicothe, O., April 4, 1887.

How to Protect New York Harbor in Thirty Days.

To the Editor of the Scientific American:

First, make arrangements for the manufacture of a lot of tubes similar to the pneumatic dynamite guns which have been tried recently, only they need not be so accurate nor effective, and, to simplify matters, steam may be used instead of compressed air, and if they were made so as to have an effective range of one-half, or even one-fourth, of a mile, they would do. Then take a sufficient number of scows and cover them with iron, lying at a very small angle with the water, and with the lower edge submerged. (If they lack bouyancy, it may be obtained by bolting timber to the lower edge of the armor, or even under the scow.) We will now arm each scow with, say, three tubes, and put on a steam boiler, or, if obtainable, air compressing machinery, and moor them one-half mile apart across the mouth of the harbor, with one tube pointing outward and one to each side. These will form our floating batteries.

We may now take all the boats which we think are quick enough of motion, and put in a close deck below the water line in the forward part and fill with cork, etc., and, by the addition of sloping armor, make impromptu Destroyers, without the submarine gun, which we will replace with one of our tubes.

These boats would be probably slow of action and easily run down, as compared with the real Destroyer; but in thirty days we could fix enough of them to load several ironclads with all the dynamite they could carry—in a state of combustion.

These boats might be held in reserve till the ironclads had passed our floating batteries—if they got past, which they probably would not, as the scows might be easily connected by cables, along which a torpedo could be run to any intermediate point, and the armor could be made thick enough to withstand any gun made, as no mobility is required.

As to protection against small boats, they would be simply burglar proof safes or rafts, so that a small number of men with small arms could keep off any number of boats, even if they could not drop a bomb into them, and thus demoralize them.

These impromptu arrangements need be kept up but for a very short time, as Captain Ericsson, the inventors of the Peacemaker and other submarine boats, torpedoes, etc., would not be idle, and, in fact, I doubt not but Captain E. would have a complete and effective Destroyer ready in thirty days, and after the first one was made, he would turn them out much faster than all the foreign navies could furnish ironclads. G.

The Eye Camera.

At a recent meeting of the Photographic Section of the American Institute, Dr. Maurice N. Miller, of the University of the City of New York, entertained the audience for an hour. The camera to the construction and application of which he wished to call attention was not a patented instrument. The camera he alluded to was the human eye. The eye was guarded as jealously and protected as carefully as the most fastidious photographer cared for his camera. The horny box, consisting of seven separate pieces, was described, as well as the wonderful means for cleaning the front surface of the optical apparatus by means of the tears.

The exposing apparatus was shown to consist of a peculiar muscular arrangement, by means of which the individual had perfect control over the admission of the light rays.

Reference was then given to the arrangement for position.

Delicate cords (muscles) were attached to the eye camera, traction upon which enabled the owner to select the field of view.

Dr. Miller then described the walls of the eye. Instead of the usual form of camera box, the eye camera was spherical.

The walls were made in three thicknesses—the outer to give strength; the middle one black, to prevent reflection and loss of light; and the inner coat, the screen or retina. The reflective media were described as a system of lenses, so arranged with reference to curvature and refractive index as to form the most perfect image on the screen. The diaphragm (the iris) was mentioned as the most perfect in form, capable of adjustment in size, according to the requirements of the individual.

Focalization in the eye was accomplished by a most wonderful condition, that of flexibility in the crystalline lens.

The curvature of the front surface of the biconvex lens could be altered at the will of the individual operator, according as near or far distant objects were to be focused. The screen of the visual apparatus was described at some length.

The Dotcor said that the part upon which the images were formed was practically an expansion of the optic nerve. That as the nerve coming from the brain entered the orbit from behind, it penetrated the two outer coats and then spread out, and by millions of minute interwoven threads formed a sheet or screen upon which the image was formed.

It was curious that, notwithstanding its structure, the nerve was not itself sensitive to light. The Doctor then described the rods and cones by blackboard drawings, and indicated how these minute elements were set in vibration by the light rays, which motion was eventually recognized by the brain as light or color.

Some very interesting facts were then brought out in connection with the physiology of vision. Dr. Miller said that experience only enables us to erect in the mind the inverted pictures of the eye. The remarkably small size of the retinal image was illustrated. The Doctor said that the diameter of the image of an object six feet square when placed forty rods away was only about one-fiftieth the diameter of a human hair. Again, that the picture on the retina of a man half a mile distant, while perfectly distinct, was so small that if the man should move six feet across the line of vision the image on the retina would travel less than one ten-thousandth of an inch; that the entire picture upon the retina was less than half an inch in diameter; and that the angle of the field of view included in a single distinct picture was only about ten degrees.

A NEW METAL INDUSTRY.—*Kuhlow's* say that in Germany gold, platina, and silver strips are welded, after the mosaic style, upon a metal ground, prepared by the incandescent process, then compressed by means of powerful presses, and finally elongated by rolling into long sheets or strips. These sheets, which are now of all colors—yellow, red, green, white, gray, and black—are made into scarfs and neckties, which, being indestructible, are considered of some practical worth. This novelty, it appears, has found great acceptance abroad, numerous orders for export having been received by the manufacturers, who are chiefly in the Pforzheim and Baden districts.

EIGHT LIGHT DYNAMO.

(*Continued from first page.*)

Size of wire on field magnet, No. 18 Am. W. G.....	0.033 in. diam.
Number of parallel wires on each leg of field magnet......	4
Number of layers of wire on each leg of field magnet..........	8
Number of layers for each wire............	2
Weight of wire on field magnet........	17 pounds.

The field magnet is made of two like parts of soft, gray cast iron, joined at the center of the yoke, and bound together by two bolts, as shown in Fig. 1. The adjoining surfaces of the yoke are accurately faced, so that when clamped together, the connected halves of the magnet will be practically the same as if made integrally.

The bore of the polar extremities of the magnet is 3⅝ inches in diameter, and the sides of the magnet around the bore are faced in the lathe to form a true support for the bronze yokes supporting the ends of the armature shaft. These yokes are bored to receive the armature shaft, and faced in the lathe upon the surfaces abutting against the sides of the magnet. The yokes are secured in their places on the magnet with their centers coincident with the axis of the bore of the magnet.

The armature shaft is fitted so as to revolve freely on its bearings, and there is a clearance between the periphery of the armature and the magnet of about one-eighth inch.

Upon the portion of the armature shaft lying between the poles of the field magnet is placed the cylinder, of seasoned hard wood of the size above given. Upon this wooden cylinder are placed the thirty-nine iron rings or washers, with intervening paper rings of the same size and about one thirty-second inch thick. The iron rings are drilled at diametrically opposite points to receive the brass rods by which the entire series is held together. The arrangement of the parts of the core of the armature is shown in Fig. 2, in which

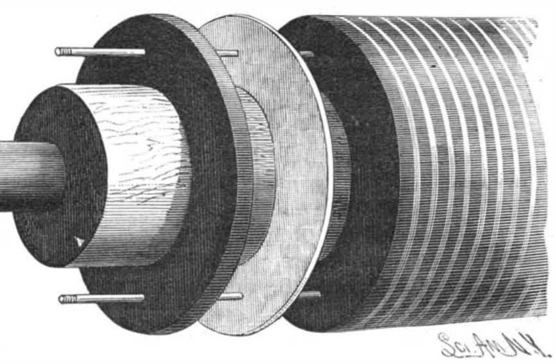


Fig. 2.—PARTS OF ARMATURE CORE.

some of the iron rings have been separated, to more clearly illustrate the construction.

The series of iron rings is secured to the wooden cylinder and the shaft by two pins passing through the rings, the wooden cylinder, and the shaft.

The edges of the end rings are rounded, to prevent them from cutting the insulation of the wires. In two of the rings, at each end of the armature core, are formed twenty-four equidistant radial slots, *b* (Fig. 3), one-eighth inch deep and one-sixteenth inch wide. The armature core thus formed is covered over its entire surface with adhesive tape, such as is commonly used by wire men for covering joints in conductors. The tape is wound spirally on the periphery of the core, and is arranged radially on the end of the core. It is also wound spirally upon the shaft one and three-eighths inches in each direction from the ends of the armature core. Into the radial slots, *b*, are driven small wedges, *a*, of hard rubber, which are allowed to project three-sixteenths inch beyond the periphery of the core.

The winding of the armature is most readily done in a lathe, as shown in Fig. 3. The armature shaft with a dog attached is supported between the centers of the lathe, with dog in engagement with the face plate. A spool of No. 20 wire* is supported in a convenient position at the back of the lathe, and after bending the end of the wire around one of the wedges, leaving about 4 inches projecting beyond the wedge, the winding is begun. The wire is carried by one hand along the surface of the armature core and through the space between two wedges at the opposite end of the core, corresponding with the space in which the coil was started. The other hand grasps the face plate of the lathe, and as the wire is carried across the end of the armature core, the face plate is dexterously turned through a half revolution, bringing the opposite side of the core uppermost. The wire is then laid between the two pairs of wedges diametrically opposite those embracing the wire on the other side of the armature. The wire is carried across the commutator end of the armature core, and the armature is returned to the position of starting by returning the face plate to its first position and the wire is laid alongside of the portion first laid on. The wire is carried lengthwise around the armature in this manner until eight parallel convolutions have been laid on. This layer of wire will extend

* The wire used is the best cotton covered magnet wire.

across the space between two of the wedges. In Fig. 4 the inner layer, B, is represented as being raised from the core, to more clearly show the position of the wire on the armature, and the inner and outer coils are widely separated; but it will of course be understood that these wires are to lie as closely as possible to the core in the working machine. The beginning or inner terminal, E, of the coil, B, is represented in black. In practice, this end of the wire is always coated with colored varnish as soon as the coil is complete, and before the two ends of the coil are twisted together, as they always are temporarily, for convenience in winding, so that there cannot be a mistake as to which are the inner and outer ends of each coil.

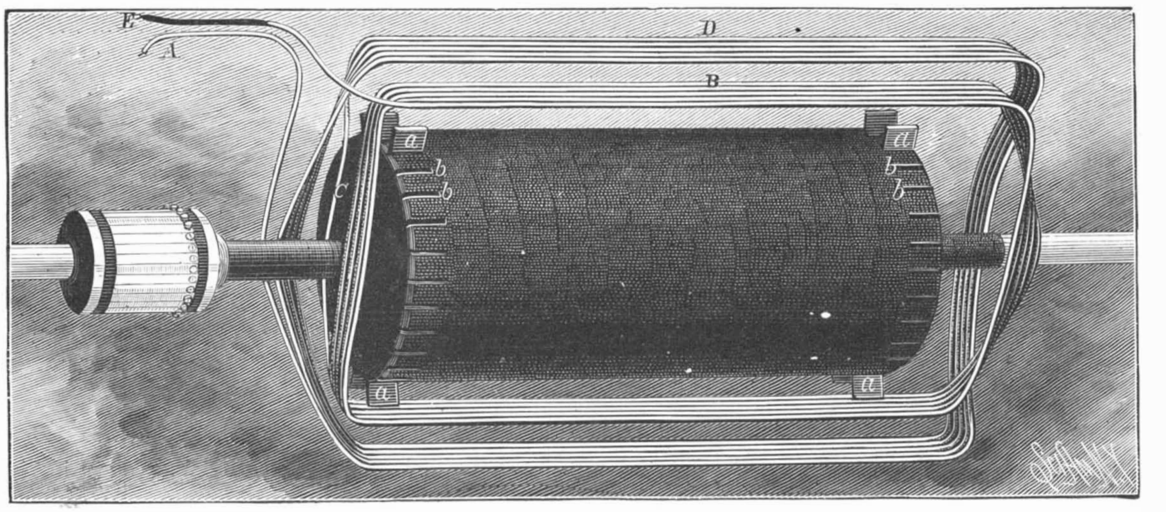


Fig. 4.—THE FIRST COIL ON ARMATURE.

After winding the inner layer of the first coil, the winding is continued, forming the outer layer, D, on top of the inner layer, by winding in the same direction, but returning by the successive coils of the second layer toward the point of starting. When the outer layer is complete, the wire is cut, leaving a projecting end about 4 inches long. The colored or inner end of the wire is now twisted with the outer or uncolored end. In this manner, the first coil is placed in the spaces 1, 1, of the armature. It will be observed by reference to Figs. 4 and 5 that the two halves of each coil are arranged across the end of the armature on opposite sides of the shaft. This secures a compact end and a minimum amount of dead wire.

After placing one coil in spaces 1, 1, in the manner described, spaces 2, 2, are filled in the same way, then 3, 3, and so on, until twelve coils are wound upon the core. These coils half fill all of the pairs of spaces 1, 1, 2, 2, 3, 3, etc., to 12, 12, with terminals, A, E, projecting from each space around one-half of the periphery of the commutator end of the armature, the end of the armature presenting an appearance which would be indicated by Fig. 5, if the coils, G F, were omitted. When the armature is half filled, the winding is continued in exactly the same manner and in the same direction as before, forming a coil of two layers, F, G, in spaces 1, 1, on top of the first coil, B, D, leaving projecting terminals, as in the case of the first series of coils. Then a similar coil is formed on top of the coil in spaces 2, 2, and so on, until each pair of spaces contains two coils, one superposed on the other, every coil being formed of two layers of wire, with eight strands in each layer.

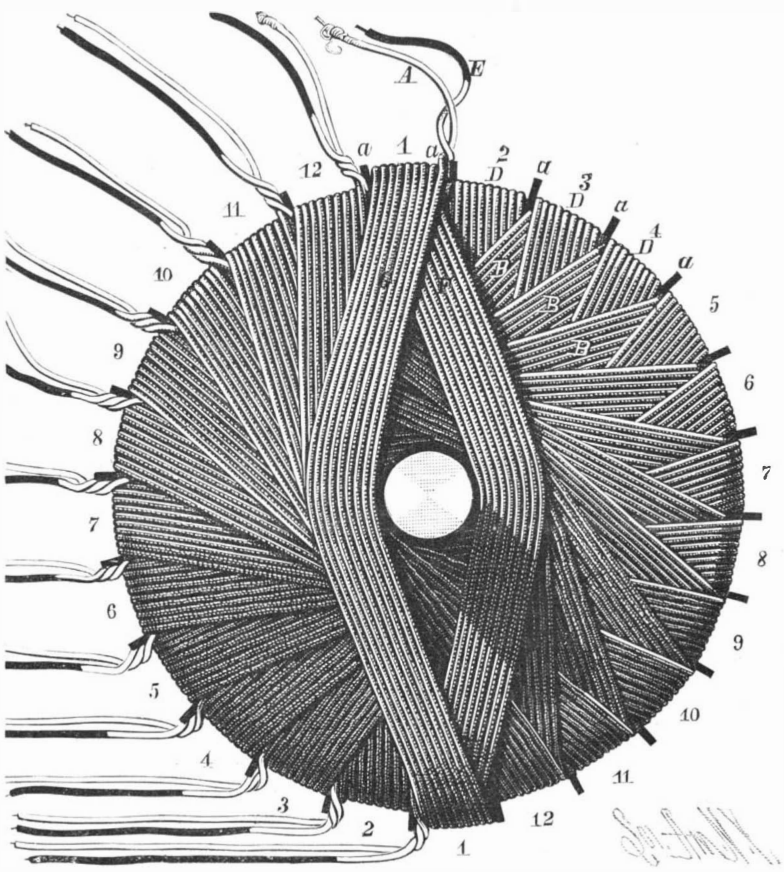


Fig. 5.—STARTING THE OUTER SERIES OF COILS.

It is advisable, before winding the outer series of coils, to bind the inner series close to the core by a winding of stout linen thread at three equidistant points in the length of the armature. As a guard against the possibility of short circuiting, the terminals of each coil, where they are in contact with each other or with other portions of the wire, should be provided with an extra wrapping of cotton. The armature thus constructed is known as the Siemens or Hefner-Alteneck armature.

There is another method of constructing the core of the armature which yields good results, but is, in some respects, inferior to the one described. The armature shaft carries a spool of wood or other non-magnetic material, upon which is wound varnished soft iron wire—the wire being used instead of the iron rings. The commutator cylinder, the method of connecting the terminals of the armature coils with the bars of the commutator cylinder, the brushes, the field magnet winding, the connections, and other features will be illustrated and described in the next issue of this journal.

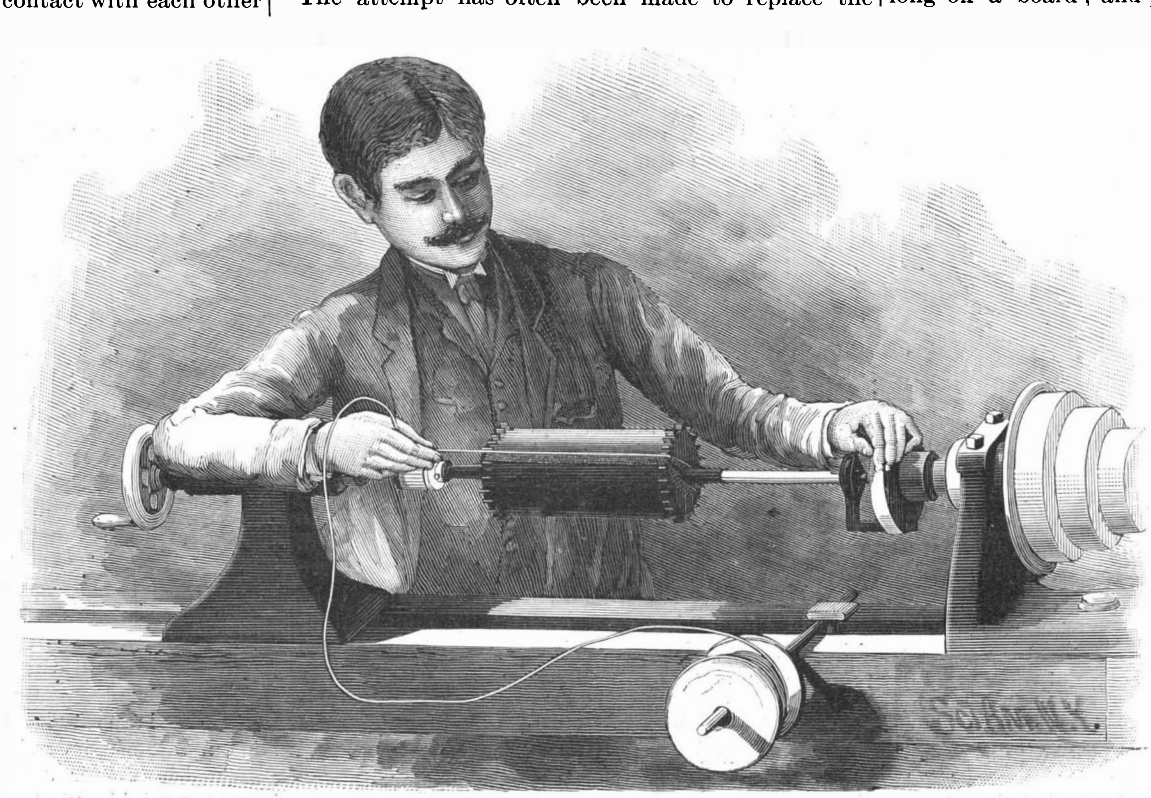


Fig. 3.—METHOD OF WINDING.

Twenty-four per cent of Norway is forest.

Wire Drawing without Pickling.

It is well known that in the manufacture of iron wire, the layer of oxide formed on the surface of the red-hot metal has to be removed by passing it through a bath of dilute sulphuric acid, an operation necessary for each reheating. The consumption of acid amounts to about 25 or 30 kilogrammes (55 to 66 lb.) per ton (2,204 lb.) of wire produced; the bath contains 1 per cent or 1·2 per cent of acid, and the rest is water. The objection to this process not only is the expense due to the use of acid, but the time required for the pickling, which requires two or three hours, and the annoyance of dealing with and disposing of the acid liquors.

The attempt has often been made to replace the pickling in acid by other processes. The oldest is one proposed by Betz in 1877, which consisted in subjecting the iron wire to successive bendings in all directions to break the scale of oxide. This was effected by passing the wire through a series of grooved rollers placed at varying angles with each other. In Von Becke's process the wire was subjected to friction, an effectual operation, but injurious to the product. An American machine, invented by Adt, subjects the wire to torsion by imparting a helicoidal motion to grooved rollers through which it passes. This apparatus gives good results. It does not quite do away with acid, but saves nine-tenths of it. The Altpeter and Bansen processes act upon the section of the wire, transforming it from round to oval, by cylinders arranged like those of universal plate rolls. The change of section does no harm if a final drawing is yet to take place, but this process leaves attached a great part of the oxide.

Wedding has recently proposed a plan, also mechanical, but based on another order of ideas. He stretches the wire while still hot to its limit of elasticity, giving it a tension of 62 to 64 kilogrammes per square millimeter (85,000 to 88,000 lb. per sq. in.). The thickest layer of oxide falls off, and the thinnest ceases to be adherent, so that a slight treatment by the Adt or Betz machine removes all scale completely, especially if water is used—preferably hot—so as not to harden the surface of the metal. The reheating is done in a lead bath. On this subject the *Bulletin de la Société des Ingenieurs Civils* remarks that the use of a lead bath would be inadmissable where the wire was to be galvanized, because the traces of lead which might remain adhering to it would ultimately interfere with the adherence of the zinc.—*Revue Industrielle.*

Ruskin Vanquished by a Mason's Trowel.

Mr. Ruskin, in the latest volume of his autobiography, says the *American Architect*, relates his experience at manual labor: "When I had to direct road making at Oxford, I sate myself, with an iron masked stone breaker, on his heap, to break stones beside the London road, just under Iffley Hill, till I knew how to advise my too impetuous pupils to effect their purposes in that matter. I learned from an Irish street crossing sweeper what he could teach me of sweeping; but found myself in that nearly his match, from my boy gardening; and again and again I swept bits of St. Giles' foot pavements, showing my corps of subordinates how to finish into depths of gutter. I worked with a carpenter until I could take an even shaving six feet long off a board; and painted enough with properly and delightfully soppy green paint to feel the master's superiority in the use of a blunt brush. But among all these and other such studentships the reader will be surprised, I think, to hear, seriously, that the instrument I finally decided to be the most difficult of management was the trowel. For accumulated months of my boy's life I watched bricklaying and paving; but when I took the trowel into my own hand, abandoned at once all hope of attaining the least real skill with it, unless I gave up all thoughts of any future literary or political career."

The Ice Palace at St. Paul.

A correspondent says the ice palace is still 60 feet high, and presents the appearance of a picturesque ruin. It is slowly melting, and occasionally an ice block comes tumbling down.

JAMES BUCHANAN EADS.

This distinguished American engineer was born in Lawrenceburgh, Ind., May 23, 1820. As a boy he showed unusual fondness for machinery, and when but eight years old was in the habit of visiting places where it was possible for him to watch the movements of mechanical apparatus.

In 1829, he moved with his parents to Louisville, and while on the journey down the river, the lad showed such interest in the machinery on the boat that the engineer was induced to explain to him the operation of the principal parts of the engine. So well did he profit by this one lesson in steam engineering, that a little more than two years later, he constructed a miniature engine, which was worked by steam. Soon after settling in Louisville, his father, perhaps seeing something of the man in the boy, fitted up for him a workshop, where he constructed models of saw mills, fire engines, steamboats, and other machines. It is said that he used to take to pieces and put together the family clock, and when he was twelve years old, he accomplished a similar feat with a patent lever watch, having no tool but his pocket knife.

In 1833, the family again moved, this time to St. Louis. During the night following his arrival, the steamer which had brought him to St. Louis was burned, and all of his father's possessions destroyed. Young Eads, only thirteen years of age, landed barefooted, without a coat upon his back, on the very spot now covered by the abutments of the great steel bridge which he afterward built. No more schooling was possible, for it was necessary to aid in supporting his mother and sisters.

He began his independent career by selling apples on the street, and for some time followed this occupation, in order to obtain the necessities of life for the family. Before long, however, he secured a situation in a drygoods store, where he remained for five years. Meanwhile he had access to an excellent library belonging to the senior partner of the firm by which he was employed, and used every opportunity to study mechanics and cognate subjects.

In 1839, he obtained the appointment of clerk on one of the Mississippi River steamers, and while holding this place began to acquire some knowledge of the waters of this capricious river, whose many changes have so bewildered its navigators. The shifting channels, now engulfing the rich plantations or flooding the large cities, were problems worthy of the greatest consideration, but time was not yet ripe for their adequate solution.

His attention was then turned to inventing, and in 1842 he designed a diving bell boat, to recover the cargoes of sunken steamers. Soon after, he formed a copartnership with Case & Nelson, boat builders, and constructed larger boats, with novel and powerful machinery for pumping out the sand and water from sunken vessels, and lifting their entire hull and cargo. This work was a thorough success, and the operations of the company extended from Balize, La., to Galena, Ills., and into the tributaries of the Mississippi. It was while engaged in the wrecking business that he gained a knowledge of the laws which control the flow of silt-bearing rivers; and he was able to say of the Mississippi a few years afterward, that there was not a stretch in its bed fifty miles long, between St. Louis and New Orleans, on which he had not stood on the bottom of the stream, beneath the shelter of a diving bell.

In 1845 he sold his interest in the company, and established in St. Louis the first glass manufactory west of the Ohio River. Two years later, this enterprise having failed, Mr. Eads returned to the business of raising steamers, removing obstructions from the channel, and improving the harbor of St. Louis. During the fire of 1849, twenty-nine steamers were burned at the landing of St. Louis and most of their wrecks were removed by him. This business proved financially successful, and in the following ten years he accumulated a fortune of half a million of dollars.

During the winter of 1855-6, Mr. Eads made a formal proposition to Congress to keep the channels of the Mississippi, Missouri, Ohio, and Arkansas Rivers free by removing all snags, wrecks, and other obstructions. A bill embodying his plans was reported on and passed the House of Representatives, but was unsuccessful in the Senate, owing to adjournment. Failing health led to his retirement from business in 1857, and the subsequent four years were spent without employment.

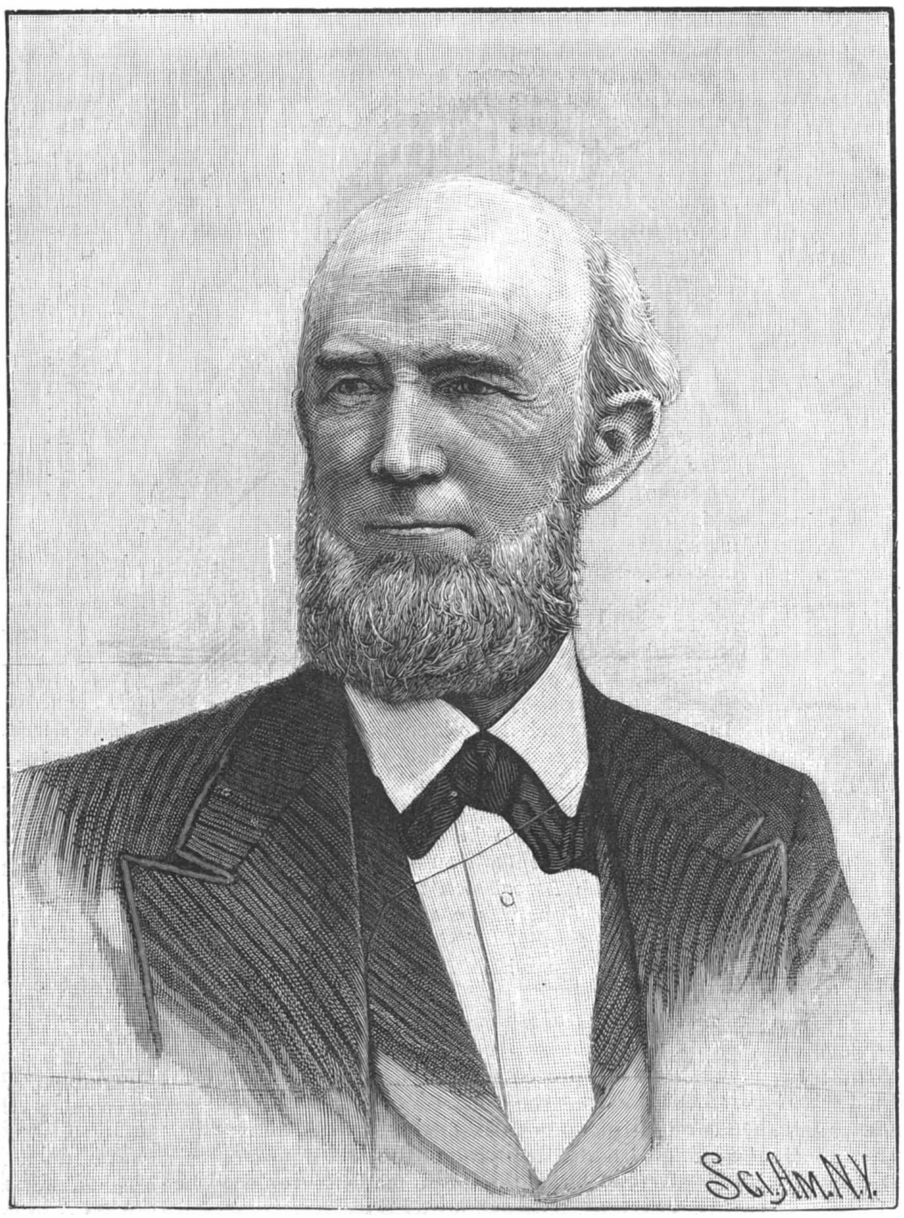
Three days after the surrender of Fort Sumter, on April 17, 1861, Mr. Edward Bates, then United States Attorney-General, wrote to him from Washington: "Be not surprised if you are called here suddenly by telegram. If called, come instantly. Under a certain contingency, it will be necessary to have the aid of the most thorough knowledge of our Western rivers and the use of steam on them, and in that event I have advised that you should be consulted." Soon after he was telegraphed for, and at once proceeded to Washington. After consultations with President Lincoln and others concerning the practicability of using light-draught ironclad vessels on the Mississippi and its tributaries, he was appointed, with Captain John Rodgers of the United States Navy, to carry into effect the recommendations which he made. He went immediately to Cairo, and there altered the Conestoga, Tyler, and Lexington into gunboats. In July, 1861, proposals were issued, calling for the construction of a number of ironclad gunboats for service on the Mississippi. Mr. Eads was found to be lowest bidder, and he was ordered to build seven vessels. The contract to finish these boats within sixty-five days was signed on August 7. The timber to form their hulls was still uncut, the rolls for the manufacture of the armor plates were not in existence, and the engines were nothing but pig iron and bars, yet in forty-five days (October 12, 1861) the St. Louis—the first United States ironclad—with her boilers and engines on board, was launched at Carondelet, near St. Louis. Ten days later the Carondelet followed, and then in rapid succession the Cincinnati, Louisville, Mound City, Cairo, and Pittsburg were launched. An eighth vessel, larger, more powerful, and superior in every respect, was undertaken before the hulls of the first seven had fairly assumed shape. Dr. Charles B. Boynton says, in this connection: "Thus one individual put into construction, and pushed to completion within a hundred days, a powerful squadron of eight vessels aggregating five thousand tons, capable of steaming at nine knots an hour, large, heavily armed, fully equipped, and all ready for their armament of one hundred and seven large guns. The fact that such a work was done is nobler praise than any that can be bestowed by words."

During 1862-3 he designed and constructed the Osage, Nesho, Winnebago, Milwaukee, Chickasaw, and Kickapoo, six turreted iron vessels, all heavily plated. The turrets on these were quite different from those of Ericsson and Coles, and their guns were worked entirely by steam. In this way, the eleven and fifteen inch guns could be loaded and discharged every forty-five seconds, and this record stands as the first application of steam in manipulating heavy artillery. In addition to the fourteen heavily armored gunboats already constructed, he converted, during the same time, seven transports into what were called "tinclads," or musket-proof gunboats, and also built four heavy mortar boats during this period. The good work which these vessels did during the war is recorded in the history of Generals Grant and Halleck's campaigns and of Admiral Farragut's capture of Mobile.

Soon after the closing of the civil war, the bridging of the Mississippi became urgent, and in 1865 a bill approving of the construction of a bridge at St. Louis was passed, but it was not until August, 1867, that work was begun. In the construction of this bridge Mr. Eads had to deal with problems which had not before confronted an engineer. It consisted of three arches, of which the central one has a clear span of five hundred and twenty feet, and is recognized as "the finest specimen of metal arch construction in the world," while the side arches are five hundred and two feet each in span. Its granite piers all rest upon the bed rock underlying the river deposits. Two of them are much deeper than any yet built, and of these, one, weighing forty-five thousand tons, was sunk to the bed rock, one hundred and thirty-six feet below high water mark, through ninety feet of sand and gravel, while the other, weighing forty thousand tons, is founded on the rock one hundred and thirty feet below high water mark. Many novel plans were designed by Mr. Eads in the construction of the caissons by which these enormous piers were sunk through the sand to the rock. In the erection of the arches, new problems likewise presented themselves. They had to be designed about two and a half inches longer than they are now in their present position, on account of the contraction which their weight causes throughout the arch. They were built out from the piers until they met at the center. The half spans near the shores of the river were upheld by huge iron guys passing over temporary towers on the piers and anchored securely on shore. On the central piers the half spans balanced each other, being built out from opposite sides of each pier. The central tubes had to be specially fitted for insertion, and their introduction was accomplished by the use of a set of telescopic tubes specially designed for this purpose by Mr. Eads. Each one of the original tubes was cut in two parts, and the two severed portions joined by an internal iron plug in which was turned a right and left screw fitting into corresponding threads turned on the inside of the tube ends. Several inches of the tube's length were cut out to permit it to be shortened up, so as to enter the space. Through the plug, pin holes were made for the insertion of strong levers by which it could be turned. By this simple method all of these enormous arches were closed. After an expenditure of exactly $6,536,729.99, this bridge was opened with appropriate ceremonies on July 4, 1874.

The deepening of the mouth of the Mississippi was a problem to which the attention of the people had already been drawn. In 1872 a commission of seven distinguished army engineers was directed by Congress to examine this subject. It reported in favor of building a canal through the left bank of the river, near Fort St. Philip, to connect with Breton Bay, by which the bars at the mouth of the river would be avoided entirely. This plan was opposed by Mr. Eads, who offered to undertake the deepening of the mouth of the Southwest Pass by a system of jetties at the sole risk of himself and his associates, without demanding any pay whatever from the government until after 20 feet should have been secured, the normal depth on the bar being about 14 feet.

Mr. Eads' proposition at once met with the decided opposition of the official experts of the United States Engineering Corps, to whom the government was in the habit of intrusting such work; but ultimately his plan was accepted, and he was allowed to begin operations on the South Pass, the smallest of the three, where, instead of a single bar with 14 feet on it, he was confronted with two, one in the sea with but 8 feet on it and one in the river with but 14 feet on it. In 1875 he began the construction of jetties on each side of the natural channel at such a distance apart that they should, by contracting the channel, quicken the current, and thus not only prevent the deposition of sediment, but should scour out the bottom and in-



JAMES BUCHANAN EADS.

crease the depth. Each jetty was over two miles in length, and was constructed of tiers of woven willow mattresses sunk in position and loaded with stones, the surface above water level being protected with rough masonry. The interstices in the structure thus formed quickly filled with silt, and became practically imperishable.

The sum agreed to be paid for the work was $5,250,000, of which $500,000 was to be paid after a channel 20 feet deep by 200 feet in width had been secured, another $500,000 after a channel 22 feet deep, and other sums on the obtaining of channels 26 and 28 feet deep respectively. But as a guarantee that the maintenance of the channel should not cost more than $100,000 a year, the final $1,000,000 of the whole sum was to be withheld until a channel of 30 feet maximum depth had been kept throughout during twenty years. Congress, however, deeming these terms unnecessarily severe, with remarkable unanimity voted to pay him $1,750,000 in advance of his contract terms after he had secured 22 feet depth. On July 8, 1879, four years after he began work on the jetties, the United States inspecting officer reported that the maximum depth of 30 feet had been secured and that the least width of the 26 foot channel was 200 feet.

By this means New Orleans has been raised from being the eleventh to the second export city of the United States. The current of the river has maintained the maximum depth ever since, and the entire cost of the jetties was one-half of the estimated cost of the proposed canal.

Meanwhile Mr. Eads outlined one of the most magnificent plans which hydraulic engineering has ever undertaken. He proposed to extend deep water from the Gulf of Mexico to the mouth of the Ohio River, into the very heart of the Mississippi River valley, by permanently locating the channel, and so putting an end to the caving of its banks. According to his belief, "the establishment of a uniformity of width would produce a uniformity of depth, and secure at least 20 feet at low water from Cairo to the Gulf. Uniformity of width and depth would insure uniformity of current and a uniform charge of suspended sediment, and this would virtually stop the caving of banks, for these are caused by changes in current velocity."

In 1879 Congress authorized the creation of a mixed commission of civil and military engineers, called the Mississippi River Commission, to consist of seven members, of which Mr. Eads was one. Its duty was to prepare plans for the improvement of the navigation of the river and to prevent destructive floods. A report adopting the jetty system was made, in which Mr. Eads' views were fully indorsed. Appropriations were made by Congress, and two reaches of the Mississippi —Plum Point, 20 miles long, and Lake Providence, 35 miles long—were selected for improvement. The low water depth of the former was only 5 feet, while the latter, 400 miles further down the river, had a depth of nearly 6 feet. Permeable contraction works, similar to those used at the South Pass, were put in position for one season in the period between two floods, and the effect produced by the works during the first flood that followed was simply marvelous. The depth was increased through the upper reach to 12 feet at low water, and through the lower reach to 15 feet, and scores of millions of cubic yards of sediment were deposited behind the permeable works, through the checking of the current. New shore lines of an approximate uniform width were developed, but later Congresses refused to continue sufficient appropriations, although enough had been accomplished to show the entire practicability of the plan.

In 1878 Mr. Eads made an elaborate report upon the improvement of the mouth of the St. Johns River, Florida, in response to a request of the municipal authorities and citizens of Jacksonville; and in 1880, at the request of the Governor of California, he visited the Sacramento River and reported upon plans for the preservation of its channel and the arrest of debris from the mines. He was asked by the Minister of Public Works of Canada, in 1881, to examine the harbor of Toronto, and subsequently submitted a report upon the measures required for its improvement. In 1882 he was commissioned by the Mexican government to examine the port of Vera Cruz, and to suggest means of rendering the entrance safe, and to protect shipping inside. His suggestions were approved by the authorities, and movements inaugurated to construct the necessary works. He likewise reported upon the harbor of Tampico.

During his different visits to Europe he has inspected the mouths of nearly every river emptying into the Baltic Sea and the German Ocean. He has also examined the river courses of the Rhone, the Danube, including the works at their mouths, and the Theiss, in Hungary; also the Suez, Amsterdam, and Rhone ship canals. Early in 1884 he was requested by the authorities of Galveston, Texas, to undertake the improvement of their harbor and the entrance to it, but the execution of this work was deferred by legislation. In the meanwhile, on the occasion of the Parliamentary inquiry into the merits of the Manchester ship canal, Mr. Eads was retained by the Mersey Docks and Harbor Board, of Liverpool, England, at a fee of £3,500, said to be the largest ever yet paid to an engineer. His evidence caused the rejection of the scheme as it then stood; and the modification by which the canal was laid out along the shore of the wide part of the Mersey, instead of being led in a trained channel through the sandy flats, was due to his advice. He was also personally consulted by the Emperor of Brazil concerning the harbors of his kingdom.

The last great enterprise to which Mr. Eads devoted his attention, and which he still leaves incompleted, was the ship railway across the isthmus of Tehuantepec, Mexico. As early as 1879, Mr. Eads determined upon this as a more promising undertaking than the Panama or Nicaragua canals. The length of the route is 134 miles, its highest point 726 feet above the level of the sea, and its heaviest grade less than 53 feet a mile. He proposed the construction of a many-tracked railroad, with turntables and other necessary appliances, and with dry docks at each end. The largest ocean steamers, heavily laden, were to be docked, placed in huge cradles, mounted on cars, and dragged overland from sea to sea by the combined force of half a dozen giant locomotives. This, he contended, was entirely practicable, because the railway can be built wherever the canal can, at one-half the cost of the canal with locks, or one-quarter the cost of one at tide level, because it can be built in one-third or one-quarter the time needed to build a canal; because more vessels can be carried in a day over the railway than through the canal; because four or five times the speed practicable on a canal can be secured; because the capacity of the railway can be increased to suit increased needs without disturbance; because it will cost less to maintain and operate it than it will to operate and maintain a canal; because it can be built and operated where the canal cannot be; because more accurate estimates can be made of the cost and time needed for its construction; and because its location is the very best of all those which are proposed on the American isthmus.

The entire cost of this stupendous work was estimated by Mr. Eads at less than $75,000,000, and he claimed that the tonnage that might naturally be expected to follow this route would pay handsome profits on the investment. A valuable concession was made by the Mexican government for the building of this road, and for several years he endeavored to persuade the United States government to undertake the building of this ship railway, but finally gave it up, and formed a private company for its construction. A bill to incorporate this company passed the United States Senate during the session of 1886–7, but failed in the House of Representatives.

In 1872 he was elected president of the St. Louis Academy of Sciences, and filled that office for two terms, delivering valuable scientific addresses when he was inaugurated. During the same year, he received an election to membership in the National Academy of Sciences. In 1881 he made an extemporary address before the British Association for the Advancement of Science, of which he was a member, at York, on the improvement of the Mississippi, also on the Tehuantepec ship railway, which were by unanimous consent ordered to be embodied in its report of the proceedings. Mr. Eads received in June, 1884, the Albert medal of the British Society of Arts, awarded to "the distinguished American engineer, whose works have been of such great service in improving the water communication of North America, and have thereby rendered valuable aid to the commerce of the world." He also received the honorary degree of LL.D. from the State University of Missouri.

Mr. Eads was a Fellow of the American Association for the Advancement of Science, a member of the American Society of Civil Engineers, and a member of the Institute of Civil Engineers of Great Britain.

His writings and professional papers appeared variously, but the most important have been collected and published as the "Addresses and Papers of James B. Eads, together with a Biographical Sketch." (St. Louis, 1884.)

The winter of 1886–7 was spent between New York and Washington, and his time devoted almost entirely to pushing the interests of the ship railway. Soon after the introduction of the bill for its incorporation in Congress, Mr. Eads went in failing health to Nassau, New Providence, Bahama Islands, where, on March 8, 1887, he died after a brief illness.

It is said of De Soto, whose remains were consigned to the waters of the great Mississippi at midnight, while the first requiems ever chanted over its surface were sung, that he came to seek a fortune and found nothing better than a tomb. Eads gained his fortune by conquering the river, and the mighty structures resulting from his genius will remain in perpetuation of his memory so long as engineering skill shall have a record in the world's history. M. B.

A correspondent says: A fortune awaits the inventor of a successful perfect dash or buggy lamp, or a lamp to be attached to a horse's breast. One that will not go out when most needed, and with sufficiently strong reflector to light the road for some distance ahead of the horse.

Tram Cars for South America.

The J. G. Brill Company, of Philadelphia, have received from South America probably the largest order for tram cars ever placed at one time. It is certainly a curious collection.

The entire order for cars consists of 352, all of which are 16 feet body. They are to run on a tram road of about 100 miles in length, and to be drawn by horses.

Some of them are sleeping cars, and one can easily imagine the expression that would flit over the average New Yorker's face at the thought of a hundred mile ride in a sleeping car with horse flesh as the means of propulsion.

The road connects a large number of small towns and cities, and is to be run over the surface of the country in the same way as we would run an ordinary street railway in our own cities. They will take on passengers and freight along the route, same as an ordinary steam road. Your readers would naturally ask here, Why build a tram road, to be run with horses, a hundred miles in length? But when I add that the country through which the road passes is a poor one, and that coal is $11 per ton and the average horse only $20 per head, they will easily see that this kind of a road will be more economical than steam.

The equipment comprises almost every kind of a car used by our steam roads. They are as follows:

Eighty combination first and second class cars. These cars have a partition through the center, dividing them into two apartments, for first and second class passengers. They are arranged to carry baggage on the roof, and have an iron ladder on one side.

Four sleeping cars. These are fitted with two double berths on either side, that is, upper and lower berths, arranged in about the regulation style of sleeping cars in this country, and are fitted with lavatory, water closet, and stoves.

Four double decked open cars. These have seven seats, each with reversible backs, and a circular stairway at each end, and top seats, with a seating capacity of 57 passengers for each car.

Twenty platform cars. All of these are the four-wheeled cars.

Twenty gondola cars. These are cars with drop sides.

Six refrigerator cars. These are built on exactly the same principle as the regular refrigerator car used for carrying dressed beef in this country.

Four chicken or poultry cars, built after the style of stock cars, with a series of coops inside.

Eight cattle cars, arranged like the ordinary cattle car of this country.

Four universal dump cars.

Two derrick cars for the lifting of heavy material on and off cars.

Two hundred box cars, like the ordinary box car, with a door on either side.—*Street Railway Journal.*

Final Test of the 110 Ton Gun.

The final proof experiment with the first of the great guns for Her Majesty's ship Benbow took place at the Woolwich Arsenal butts recently. The loading of the gun, which will be performed on board ship by hydraulics, had to be carried out by hand, and was a difficult and tedious process, but at length the proof shot, weighing 1,800 pounds, was driven forward of the powder chamber, and eight octagonal cartridges were packed in behind it, each weighing 125 pounds, or an aggregate of exactly 1,000 pounds. The powder was of a slow burning description, technically known as "S. B. L." Most of the preceding rounds have been fired with Westphalian brown powder, and the velocities have varied with the weight of charge from 1,699 feet per second, with a pressure 9·65 tons, to 2,078 feet with 18·7 tons pressure. On the gun being fired it was found that the shot had achieved an initial velocity of 2,128 feet per second, with the remarkably low pressure of 16·1 tons. This velocity is equal to a rate of over 24 miles per minute or over 1,400 miles per hour. A second round was fired with precisely similar results.

Wood and Iron thinks it is well to remember the following data in relation to the strength of material:

The strength of shafts, for either bending or twisting, varies as the cube of the diameter. Thus a 2 inch shaft is eight times as strong as a 1 inch shaft.

A 1 inch shaft, running 100 revolutions per minute, will transmit 1 H. P. A 1 inch shaft will safely stand the force of 50 pounds at the end of a crank 1 foot long.

The power that a belt can transmit varies directly as its width and speed, with the limit of 5,000 or 6,000 feet per minute.

A 1 inch belt running 800 feet per minute will transmit 1 H. P.

The strength of gear teeth varies as the width of the face and the square of the pitch. A gear of 1 inch pitch and 1 inch face will stand a strain of 500 pounds.

The tensile strength of wrought iron rods varies as the square of the diameter. A 1 inch rod will support 7,000 pounds, and a 2 inch rod four times as much.

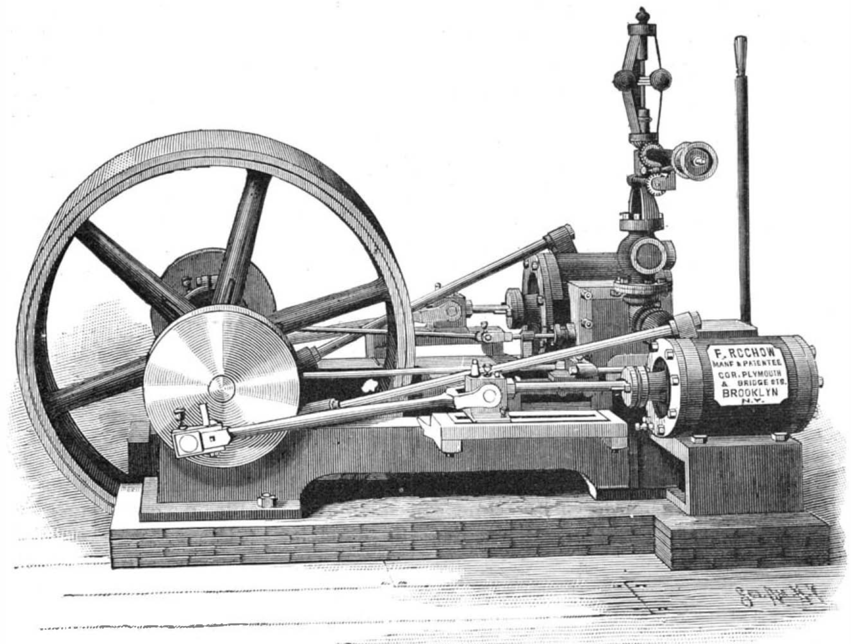
IMPROVED COMPOUND STEAM ENGINE.

The illustration herewith presented shows a compound engine in which the two cylinders are at each end of the crank shaft, the cranks being set at a right angle. This engine is designed so as to use steam expansively, is of the simplest possible construction, and every detail is easily accessible. The stuffing boxes, crossheads, connecting and eccentric rods are all open, and can be inspected at a single glance from any point, and can be adjusted in the shortest possible time, with the commonest engineer's tools. The cylinders are braced to the main pillow blocks, so as to make the whole construction a rigid, self-contained machine. The cranks being at right angles insure a very uniform motion with a comparatively small fly wheel. There is a patented starting valve attached to the engine, which, when used for starting the engine, is thrown over its full stroke. In this position it lets the live steam into the low pressure as well as the high pressure cylinder, and connects both exhausts directly with the atmosphere. After the engine is started up, this valve is thrown back about half its stroke, when it connects the exhaust of the small cylinder with the steam chest of the large one, and the exhaust of the latter with the atmosphere, thus causing the engine to work as a compound. This engine can, therefore, be started positively in any position. All of the parts are made of the best material, the shaft and rods being of superior steel, and all brasses of phosphor-bronze.

While it is a well appreciated fact, and one understood by engineers, that for factory purposes, where the power used is very variable during the day, a well designed single cylinder engine, with an automatic cut-off, a large and heavy fly wheel, and a solid foundation, gives in the long run the best result in economy, still there are often a great many other conditions and requirements that have to be consulted to make a proper selection of the best adapted engine in each case.

Where the power required is substantially uniform, this engine is well adapted—an automatic cut-off being in that case unnecessary; and owing to its compactness and rigidity, it can be used in a small space and where a solid foundation cannot be obtained. Its construction makes it particularly serviceable for all work requiring a constant and unvarying speed, this advantage being secured by the relative position of the cranks and the action of the steam in the two cylinders.

This engine has been patented by Mr. F. Rochow, of Bridge and Plymouth Streets, Brooklyn, N. Y.

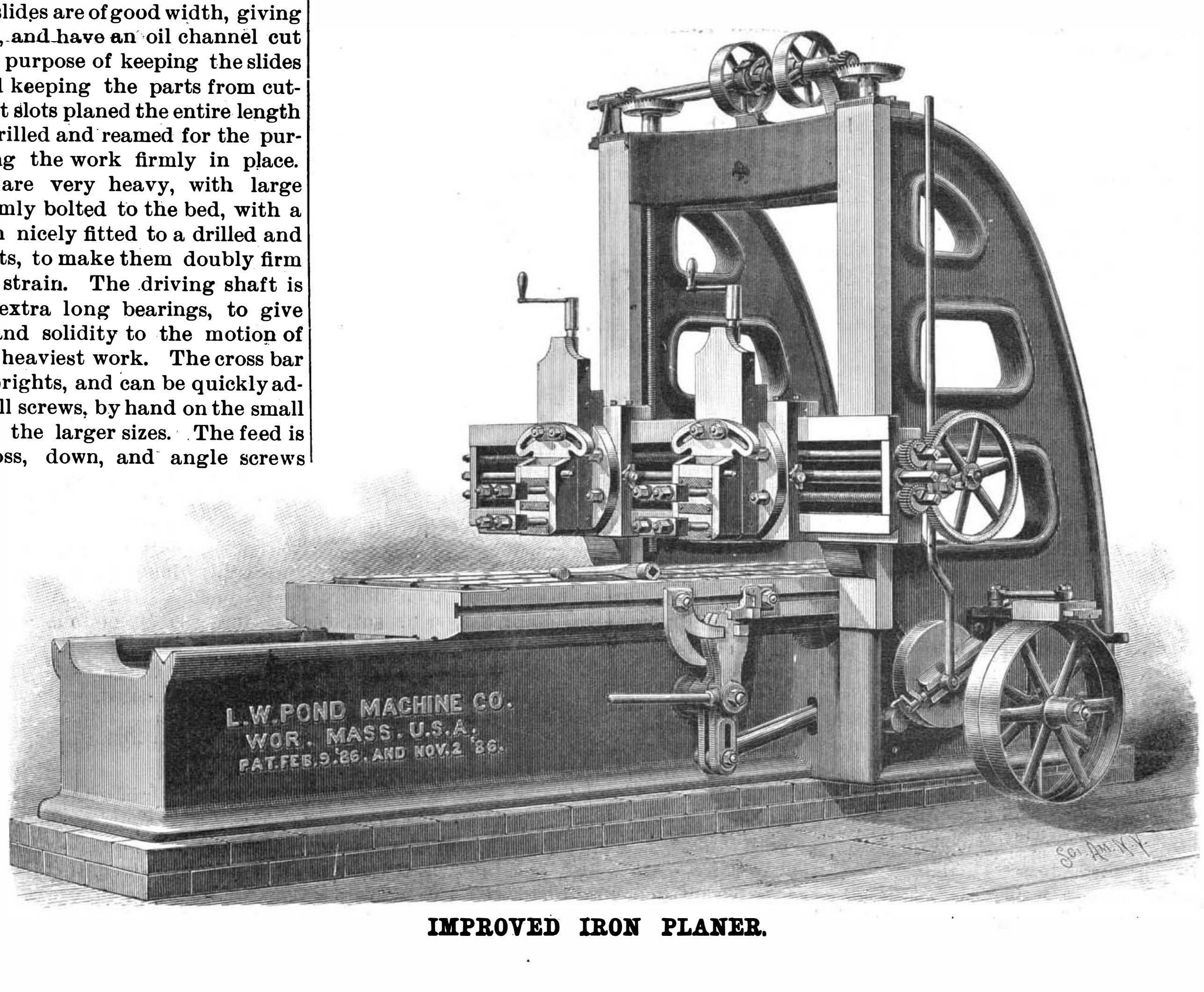


ROCHOW'S IMPROVED COMPOUND STEAM ENGINE.

IMPROVED IRON PLANER.

The accompanying cut represents one of the large size iron planers made by the L. W. Pond Machine Co., of 140 Union Street, Worcester, Mass. The machine is of new design, heavy and strong.

The bed is of unusual length in proportion to the length of the table, leaving but a small part of the table to overhang when planing the extreme length. The table is extra heavy, the slides are of good width, giving an extra wearing surface, and have an oil channel cut the entire length, for the purpose of keeping the slides perfectly lubricated, and keeping the parts from cutting. There are three bolt slots planed the entire length of the table—the holes drilled and reamed for the purpose of packing or holding the work firmly in place. The posts or uprights are very heavy, with large breadth of base and firmly bolted to the bed, with a large additional steel pin nicely fitted to a drilled and reamed hole in both parts, to make them doubly firm against a heavy lateral strain. The driving shaft is made of steel, fitted to extra long bearings, to give steadiness, smoothness, and solidity to the motion of the table when doing its heaviest work. The cross bar is firmly bolted to the uprights, and can be quickly adjusted by the rise and fall screws, by hand on the small sizes and by power on the larger sizes. The feed is transmitted to the cross, down, and angle screws through the driving shaft by a recently patented device, and runs perfectly free and loose after having done its work at the end of the stroke. The reversing motion is of recent invention, covered by patent, and can be easily adjusted to give either belt more or less lead to prevent an unpleasant squealing of the belts when the motion of the machine is reversed, and is entirely under the control of the operator at any part of the stroke.



IMPROVED IRON PLANER.

New Inman Steamer.

The Inman and International Steamship Company, limited, has contracted with Laird Brothers, of Birkenhead, for a transatlantic steamship. She will be built of steel, with triple expansion engines and twin screws, and is to be superior in speed to anything now afloat. Her dimensions will be: Length over all, 500 feet; beam, 62 feet; depth of hold, 43 feet; 17,000 horse power; 8,500 tons register. A feature of the ship will be her longitudinal bulkheads, which, in connection with the usual transverse bulkheads, will greatly increase the number of watertight compartments. Her boilers and engines will be protected by side coal bunkers. Her large passenger capacity, it is intended, will be fitted up for 350 first-class passengers. She will be delivered in the early spring of 1888. The construction of the ship will be followed by that of others, and important improvements in ships of the Inman line now in service.

Settlement of a Great Building.

It seems that the magnificent Palace of Justice at Brussels, one of the most costly structures in Europe, has shown evidences of a settlement which may or may not prove to be serious. The *Wiener Bauindustrie-Zeitung* says that early last fall, during the vacation of the courts, the ceiling of one of the court rooms fell without warning, and another followed almost immediately afterward. There had been evidences previously of injury to the lower portion of the building from the dampness of the ground, but no movement had been noticed. However, a third ceiling soon fell, and cracks began to show themselves in a number of others. The newspapers raised the alarm, and called for an immediate investigation, and the minister of justice appointed experts, who made a thorough examination of the building, and reported that no less than fifty-three ceilings were in danger of falling. They did not attempt to assign a cause for the cracking of the plastering, but contented themselves with taking measures for making the threatened ceiling secure and repairing those that had fallen. There were, however, of course, plenty of amateur explanations of the trouble, most of which accounted for it on the theory that the layers of chalk on which the building rests had been so saturated by the springs which exist in them, that they had yielded under the weight of the building and allowed it to slide down hill, as the Albany capitol is often supposed to be doing. There may be something in this, but it will probably take time to determine whether any action of the sort is really taking place. Meanwhile, there is no need of being in quite such a hurry as one of the Brussels editors, who suggested that, as the building was sure to fall, it might be well to take advantage of the opportunity to raise a little money to go toward the expense of rebuilding, to put on special trains on the government railways to bring strangers to witness the catastrophe. The fall of the tower, particularly, would attract visitors from all parts of the Continent, to say nothing of the English, who would come over in a body to witness the crash.—*Amer. Architect.*

A Perfect Weld without Fire.

A correspondent of the *Blacksmith* writes as follows: "I have never seen anything in the columns of your paper relative to making a perfect weld of steel without fire or borax. A job came to my shop a few days ago in the shape of two pieces of three-quarter inch round steel, welded together end to end. A taper plug of steel was in one end of a shaft on which a corn burr was running. The plug of steel was bearing against a like piece of steel in the frame, the object of this being to tighten the burrs. Owing to a loose box on the shaft, the shaft got to jumping, giving a side motion and creating friction enough to weld the two pieces of steel together as stated. The two pieces of steel were hardened."

[It is not a very uncommon thing, adds the *Scientific Press*, for a steel spindle in a spinning mechanism, when running at great speed, as it does in a steel cup, with perhaps a little wabbling, to suddenly stop its motion and become thoroughly welded to the cup. Of course this can occur only when the oil in the cup is exhausted.]

Tenacity of Life in a Pup.

While running a poultry yard in the suburbs of Philadelphia, and a business in the city at the same time, I had but little time for home work before going to business. To my great regret, a litter of mongrel Scotch terrier pups came into the world, which must be got rid of. Early in the morning I took the first one and placed it in a pail of water with another weighted pail on top, and left it until I was through feeding fowls and pigeons, when it was apparently as dead as a pup could be.

Not having much time, I dropped it into a post hole where a fence had been removed. The hole was filled by a forcible use of the boot heel on the sides of the hole, when I left for town and spent the entire day there. On my return home at night, and while passing about the yard, I several times heard the cry of a pup, as I supposed, and at last was attracted to the buried pup by its cries. I secured a spade and dug it out, just as lively as it was before drowning.

JOS. M. WADE.

ENGINEERING INVENTIONS.

A rail joint has been patented by Mr. Joseph D. Green, of Marshall, Mo. Two sections are formed to cover the joint, the one with a groove and the other with a rib fitted thereto, the construction being such that these sections can be clamped or locked over the joint and held in place by spikes, by which the base of the meeting rails will be firmly held in position.

A car coupling has been patented by Messrs. James N. Moore and Abraham L. Miner, of Lowell, Ind. The construction is such that when the cars are run together, the link on the adjacent car will strike a beveled end of the drawbar and be guided downward into a notch, when the spring will return the drawbar to its normal position and couple the cars, the device being one which can also be operated from the sides or top of the car.

AGRICULTURAL INVENTIONS.

A hay sling has been patented by Mr. John M. Hart, of Oswego, Kansas. The invention consists of two bars provided with ropes at their ends and with means for holding them spaced, and with devices for locking and releasing them, to facilitate the unloading of hay or grain from a wagon and storing it in a barn.

A plow has been patented by Mr. Andrew L. Thompson, of Millbrook, Ill. It is so made that when the blades meet large stones, roots, stumps, or other obstructions, a fragile pin will be broken and the blade will be turned back without damage until the obstruction is passed, with other novel details of construction and combination of parts.

MISCELLANEOUS INVENTIONS.

A scarf holder has been patented by Mr. John E. Eayrs, of Washington, D. C. It consists of an elastic strip with an attaching pin at one end and a key hole slotted clip at its opposite end, there being formed a combined clamp and button, with other novel features, for securing the lower end of the scarf to a shirt front.

A tobacco conveyer has been patented by Mr. Henry B. Light, of Simpson's, Va. The apparatus comprises an inclined cable, a rack having hooks at its upper opposite ends engaging the rope, and lower hooks adapted to receive the tobacco stick, for convenience in transporting tobacco from the field to the barn or storehouse.

A window cornice has been patented by Mr. William C. Doscher, of New York City. The front center piece of the cornice has flanged cleats at its back, and the sides are made in sections to slide in these cleats, so that by extending them or shoving them inward the cornice may be adjusted in length to suit windows of different width.

A curry comb has been patented by Messrs. Charles and Joseph Knopp, of Winona, Minn. This invention covers a novel form of device wherein the comb proper is provided with two operating faces, either one of which may be brought into play, inter-coiled wires being used upon the limbs of the animal and toothed flanges of a plate upon the body.

A rotary saw sharpener has been patented by Mr. Robert Gaskin, of Fairville, New Brunswick, Canada. This invention covers an adjustable saw holder mounted on a sliding frame, means for imparting forward and backward motion to the frame, a device for turning the saw automatically the distance of one tooth, and a stationary grinding wheel.

A nut has been patented by Mr. John C. Shellito, of Penn Run, Pa. It is formed with an internal thread and an externally threaded projection, combined with a plug or bolt with an internally threaded socket and an externally threaded projection, the nut being designed more especially for use in connection with hollow axle skeins.

A steam steering apparatus has been patented by Mr. Samuel G. Martin, of New York City. It consists of two lines attached to opposite sides of the rudder and passing over abutments, in combination with a steam cylinder, a piston rod passing entirely through it, and connected at its ends to the lines, to act oppositely and simultaneously upon them.

A planter has been patented by Mr. Millard F. Myers, of Greenville, Ohio. The main object of this invention is to provide a machine particularly adapted for planting potatoes, although it may be used for other planting, and it is so made that two rows may be planted at the same time, or one row, or the device may be employed as a check row planter.

A nut lock has been patented by Mr. Zachariah F. Jones, of Scottsville, Va. It has a locking plate with an opening contracted or reduced in width toward one end, and having a groove formed in its under side, the plate being adapted to be placed on the bolt and moved longitudinally along it, in connection with a securing plate, and other novel features.

A cattle guard has been patented by Messrs. Pleasant P. Linder and Rufus P. Bryant, of Jacksonville, Ala. This invention covers a peculiar construction and combination of parts to provide a guard that will effectually prevent cattle from entering adjoining fields traversed by a railroad, the invention covering a specially contrived counterpoised gate and other novel features.

An automatic lubricator has been patented by Mr. Joseph Patrick, of Frankfort-on-the-Main, Germany. This invention is based on the fact that metals have different expanding coefficients when heated, providing adjacent surfaces made of different metals, that when in a quiescent state will close the feeding of the lubricant, but when heated will separate on account of their different expanding coefficients.

A gas generator has been patented by Mr. Antonio Ordonez y Ponce, of Matanzas, Cuba. It has a gas preparatory cylinder with oblong screens, and connected with another cylinder, also having revolving screens which mix the gas and air, revolving under a high rate of speed, for mixing and making gas with hydrocarbons, for all purposes where a high or strong heat is needed.

A continuous recording seal and door fastener has been patented by Mr. George J. Ferguson, of Greenville, Texas. It is a device for fastening the door of a car or other sliding or hinged door, which is accomplished by a single movement of a lever, and in such way that the initial and number of the car, or other name or number, will be impressed on the seal paper slip each time the door is fastened.

A harness saddle has been patented by Mr. Alexander P. Waddell, of Union City, Tenn. It is intended especially for plow or heavy draught horses, and consists of a spring metal tree, with side bars and cross bars, and an intermediate or central cross bar, the pads connected therewith, so that the saddle will fit horses of different sizes, and afford ample ventilation to the back of the animal.

A barrel cover has been patented by Messrs. George J. Broemser and Edward D. Bradshaw, of Little Rock, Ark. The cover is made in hinged sections, through one of which is an opening to which is secured a box intended to exhibit a sample of the contents of the barrel, to facilitate examination and promote the convenience of grocers and others using a variety of goods kept in barrels.

A rein holder has been patented by Mr. Charles E. Austin, of Salmon Falls, N. H. It is made of a plate of elastic metal cut or stamped out to form a base plate, with opposite end tongues and attaching lips or tags, whereby a rein slipped into the holder will be firmly held, or may be clamped flatwise between the elastic tongues and the base plate of the holder.

A weather strip for windows has been patented by Mr. George W. Everett, of New York City. This invention relates to that description of weather strips which consist of flexible strips of rubber, which are attached to the sashes, the parting strips being grooved for the free edges of the elastic strips to fit into and work up and down within, with other novel features.

An adjustable hair spring fastening for watches has been patented by Mr. Louis R. Kaufmann, of Lexington, Mo. This construction is such that in all cases the adjustment is guided and is not a matter of guesswork and repeated trials, the plug or stud not being fixed, but adjustable, so that the lever can be conveniently brought into bear or the spring adjusted with reference to the usual regulator.

A stove has been patented by Mr. Charles Rohlfs, of Brooklyn, N. Y. The stove body is made with an open air heating space at the bottom, with slots opening outside of the stove at the top of said space, upright hollow columns communicating with the air-heating space and open at the top, there being suitable dampers to close the slots and the hollow columns.

A turntable has been patented by Mr. Abraham Ayres, of New York City. This invention covers a novel construction of turntable, to facilitate the turning of street cars at the end of the route, the design giving a large leverage when the car is turned, while a truck or other vehicle driven upon the edge of the table will not cause displacement or too much tipping.

A gauge for mouldings has been patented by Mr. William T. Farrell, of Chicago, Ill. Combined with a bevel stock having a socket in its head and a longitudinal slot at right angles to the main slot, formed by the two sides of the stock, is an adjustable sliding stem with a catch, and on its top a disk and pointer, with other novel features, making a device for promoting accuracy in obtaining lines, angles, etc., in working stone.

A reel has been patented by Mr. William Slote, of Brooklyn, N. Y. The reel frame is formed entire from a single piece of metal plate, the cross piece being pressed into concave form, and the arms bent parallel with each other and formed with central holes to form bearings for the spool journals, making an improved fishing reel which is exceedingly cheap and simple.

A trunk attachment has been patented by Messrs. James E. McDowell and Thomas Medford, of Huntington, West Va. To each end of the trunk there is pivotally connected a link, there being formed two cuts in the upper ends of the links, the metal being bent inward to form a projection between the cuts, the device being for connecting the body and tray in a specially convenient way.

A ditching machine has been patented by Mr. Louis Arsene Desy, of Winnipeg, Manitoba, Canada. This invention provides means for guiding the propelling wheels, for raising and lowering the rear end of the machine, thereby gauging the depth of the ditch, means for rotating the excavator from side to side on a vertical pivot, whereby a trench may be dug with a given slant on its side embankments, and the dirt raised and discharged to one side.

A pump has been patented by Mr. Robert F. Dobson, of Darlington, Wis. It has a single valve, a vertical tube, a horizontal tube connected to the lower end of the vertical tube, an air chamber connected to the horizontal tube, and a piston in the vertical tube, the parts being so connected and arranged that the pressure will be equal on both faces of the piston, and the pump can be worked with great economy of power.

A machine for forming veneer drums has been patented by Messrs. Wilson Godfrey and George W. Halstead, of Brooklyn, N. Y. Three sheets of veneer are first glued together, the grain of the central sheet crossing that of the other two, to prevent splitting and cracking, the united sheet being then turned over a former and the edges united, and while upon the former the sheets are compressed while the glue is warm, the machine enabling the lapped edges to be firmly clamped while on the former and then withdrawn from the forming cylinder.

NEW BOOKS AND PUBLICATIONS.

A TREATISE ON SIMPLE AND COMPOUND OPHTHALMIC LENSES. By Charles F. Prentice. New York. 1886. Pp. 41.

This work is a simple and clear presentation of its subject. Graphic methods are principally used, the object being to keep the matter within the range of the layman. The different kinds of lenses are illustrated by drawings, giving the lines of refraction and the establishment thereby of the foci. The subject of cylindrical lenses, and of the effects of combining two cylindrical surfaces, one for front and one for back of the same lens, with axes either parallel or perpendicular (crossed cylindrical lenses) to each other, is very excellently illustrated by graphic methods. The drawings are reproductions of Mr. Prentice's pen work. A concluding section on asymmetrical lenses closes the text. Finally, two tables of crossed cylinders and their sphero-cylindrical equivalents, very elaborately worked out, are given.

PRACTICAL ELECTRICITY. By W. E. Ayrton, F.R.S. Cassell & Co.: London, Paris, New York and Melbourne. 1887. Illustrated. Pp. xvi. and 516.

This work professes to be a laboratory and lecture course for first year students of electrical engineering. It is intended as a manual for practical experimentation in the science. It starts with a consideration of the electric current, its direction and its measurement. Under this head such subjects as calibration of galvanometers and measurement of distribution of magnetism in a permanent magnet are treated of, as well as the generalities of the matter. Galvanometers are described more at length in a special chapter. Electromotive force, difference of potentials, quantity and density, and their measurement are fully defined and described. Under potential the influence of the shape of the conductor is elaborately treated. Resistance receives a full chapter, the measurement of it being given in detail, along with the subject of heating of conductors and work of currents. Current generators come next. In this section the author introduces a new abbreviation, P. D., for difference of potentials—a very good suggestion, and resembling Daniell's abbreviation E. M. D. P. Insulation, quantity, and capacity, commercial instruments, such as ammeters, voltmeters, and a chapter on power and its measurement, with what has gone before, make up the bulk of the work. Some specimens of instructions for experiments and a very full index complete the book. It is designed for use by students examined by the City and Guilds of London Institute. This gives it a slightly local flavor, but it is a most admirable work, and well worthy of its distinguished author. The illustrations are numerous and particularly good.

* * Any of the above books may be purchased through this office. 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.

(1) H. P. S. writes: I have in use a number of paper lamp shades for coal oil lamps; they are yellow and sooty on the inside, but otherwise good, though they do not reflect the light enough. Is there any white composition with which I can paint the inside so as to increase the reflection? A. Try pasting new paper over their interiors, or give them a coat of alcoholic solution of shellac, and paint with zinc white. The purchase of new shades is probably your best plan.

(2) F. R. L. asks: Can a good carbon for zinc carbon batteries be made from coke? If so, how? A. The coke must be ground to fine powder, mixed with sirup or coal tar, pressed into moulds, and baked. One or two dippings in coal tar or sirup while hot, followed by baking, will improve it. 2. Can half a pint bichromate cell run an electric bell 50 feet from touch button? A. Yes; but for intermittent use you should select Leclanche or some similar open circuit battery.

(3) F. H. asks: What size pipe and how high would I have to run it to get from 80 pounds to 90 pounds pressure from a cask, the same being full of water and the pipe tightly fitted in the top? A. 180 to 200 feet would be needed.

(4) F. E. S. writes: In leveling the foot of iron bridges, iron turnings have been and are used, and sal ammoniac is put into the turnings to rust them and make them more compact. Will the sal ammoniac rust the bottom of the bridge or plate, or does it exhaust its power on the turnings, with which it acts as a cement? A. If there is not an excess of sal ammoniac, no harm can occur to the foot plates beyond a slight surface rust.

(5) R. D. S. asks: Would there be any power gained by using two windmill wheels of the same size, one directly behind the other, the slats in the rear wheel being the reverse of those in the front, thus giving it a reverse motion, and both wheels working upon the same pinion on the upright shaft? A. Theoretically there is power thus gained, but the mechanical difficulties have heretofore been a serious obstacle to their use, simplicity of construction being of the utmost importance to the successful running of windmills.

(6) J. B. asks how the cushions of a steam launch are made to answer as life preservers. A. By making them of finely divided cork in waterproof canvas covers.

(7) H. C. S. asks: Is there any rule to estimate the cost of distilled water at a given price for coal? Form of boiler and steam pressure both immaterial. A. The best regenerative system of distillation produces from 13 to 14 pounds of water per pound of coal, to which must be added interest on plant, labor, and repairs.

(8) J. J. K. asks: How I can remove the ink on postal cards? I have quite a number that I had printed and never used. A. There is no satisfactory process of accomplishing this. It can only be partially done with a good deal of difficulty.

(9) E. E. H. asks (1) what substance is used by plumbers for covering lead pipe and sheet lead, to prevent the solder from sticking to it. A. Lamp

black mixed with thin glue or mucilage. 2. Of what material is the wrapper made that is used for spreading the solder? A. Very generally of bed ticking. 3. What grade of solder is the best for fastening lead pipe? A. For wiping, equal parts tin and lead.

(10) D. A. H.—We know of no compositions cheaper than the metals they are composed of. Common yellow brass is the cheapest that can be made with copper. Cast iron is the cheapest metal.

(11) E. T. S. asks the best polish for the brass on steam engines. A. Whiting or chalk mixed with engine oil is the best to keep the brass work bright. When the brass work gets black or stained, use oxalic acid mixed with tripoli. Rub in all cases with a woolen cloth.

(12) A. R. asks if Bessemer steel has, when rolled, any more spring than iron. A. It depends on the amount of carbon contained. As usually made, it has very little more elasticity than iron; has a little spring when rolled or hammered hard; will not harden, but may be casehardened.

(13) D. E. S. asks how deep it is practicable to go down in diving bells, and with submarine armor. A. 75 to 100 feet is about the working limit, though divers have thus been down over 200 feet.

(14) O. M. C. asks the process for writing or making objects on glass that can only be seen when you breathe upon it. A. The drawings are made with pencils of talc or soapstone. They are sometimes very lightly etched with hydrofluoric acid.

(15) W. F. asks: 1. What is the cause of blue vitriol turning into powder? A. It is due to efflorescence, or the giving up of its water of crystallization. 2. Does it have any strength when it is so turned? A. It is stronger.

(16) H. M. E. asks: At a given temperature—20° C.—how many volumes of gas will a given volume of liquefied CO_2 yield when the pressure is removed? How much at 0°? A. All measurements being taken at 20° C., one volume of liquefied carbon dioxide will give 450 volumes of the gas; all measurements being taken at 0° C., one volume of the liquid will give 480·4 of the gas. These are approximate, but nearly right.

(17) R. B. asks: What is the receipt for putting quicksilver on the back of a looking-glass? A. This is usually done by coating the glass with an amalgam. For this purpose a large, perfectly flat stone table is provided; upon it is evenly spread a sheet of tin foil without crack or flaw; this is covered uniformly to the depth of one-eighth inch with clean mercury. The plate of glass perfectly cleaned from all grease and impurity is floated on to the mercury by sliding, so as to exclude all air bubbles. It is then pressed down by loading it with weights, in order to press out all the mercury which remains fluid, which is received in a gutter around the stone. After about 24 hours, it is raised gently upon its edge, and in a few weeks it is ready to frame.

(18) B. L. A. asks what temper steel should be to make a strong permanent magnet. A. Tool temper; draw to about a straw color.

(19) W. M. H. asks: What bodies are the poorest conductors of heat? A. Silk is the poorest conductor, and the resins, glass, and wood are all poor conductors. 2. A recipe for a violin varnish. A. Use mastic varnish; or, 12 parts sandarac, 6 parts shellac, 6 parts mastic, 150 parts 95 per cent alcohol, 6 parts Venice turpentine; mix and dissolve warm.

(20) J. B. B. asks: What can I put in water to lower the boiling point to 185° Fah., so that the temperature will not rise any higher, whatever fire is under the copper? A. The addition of alcohol will lower the boiling point of the mixture; but will evaporate so that the boiling point will continually rise.

(21) R., D. & Co.—For etching on cutlery you will require a ground wax composed of equal parts asphaltum, Burgundy pitch, and beeswax, melted together and thoroughly incorporated. In applying it, use a dabber, or ball of cotton covered with silk. Warm the piece of cutlery so that a stick of the wax will readily melt by touching. Smear a small quantity of the wax on the blade or articles, and dab it evenly all over the surface. When cold, scratch the required design or name on the surface and touch the parts with acid (nitric acid 1 part, water 4 to 6 parts), using a camel's hair pencil to cover the surface and bring the acid into contact with all the lines. In a few minutes the biting is done. Dip in hot water to wash off the acid, and the surface may be cleaned by wiping with benzine. Another way is to make a varnish of asphalt and turpentine, with a few drops of linseed oil to make it tacky. Have a rubber stamp made of the required design, with a border, so as to stop off around the design. Stamp the goods, and with some of the varnish thinned down with turpentine and a brush stop off the surrounding parts; or surround the design with a small rim of beeswax, and apply the acid as above.

(22) Reader asks: 1. What will remove warts from the hand with little or no pain? A. Get a piece of sal ammoniac about the size of a walnut; moisten the warts, and rub the sal ammoniac well on them every night and morning for a fortnight. 2. If I manufacture an article or compound, have I a right to sell it anywhere and everywhere, without paying license or tax? If I take orders for a book which is sold by subscription only, have I a right to take the books along with me and deliver them as I secure orders without paying license or tax? A. You must pay license for some kinds of business in certain localities, but the different laws for taxing drummers in several of the States have been decided unconstitutional. 3. A recipe for making hair dye from walnut juice? A. This consists simply of the expressed juice of the bark or shell of green walnuts, to which a little rectified spirit is commonly added for the purpose of preserving it, with a few bruised cloves, and the whole digested together with occasional agitation for a week or fortnight, when the clear portion is decanted, and if necessary, filtered. 4. A SUPPLEMENT containing receipts for making cosmetics, cements, blackings, etc.? A. See Cements, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158; for cosmetics and blackings, see "Techno-Chemical Receipt Book," which we can send for $2. For special treatment of freckles, moles, etc., see SUPPLEMENT, 507.

(23) T. G. C. asks: 1. Why does churning make butter? A. Agitating the milk causes the rupture of the coating of the butter globules contained in the milk, and their fatty contents then collect together. 2. What can I use to clean carpets. A. Use about 3 gills of ox gall in a pailful of water; rub with a soft scrubbing brush some of the ox gall water on the carpet, which will raise a lather. When a convenient sized portion is done, wash the lather off with a clean linen cloth dipped in clean water. Let this water be changed frequently, and when all the lather has disappeared, rub the part with a clean dry cloth. Mixtures of magnesia and fuller's earth made into a paste are used to remove grease spots.

(24) E. M. D. asks how he can prepare water for fire extinguishing purposes, to be used with a common pump. What will be the advantage over ordinary water? A. We doubt whether there is anything practical to use in the way you propose. Water saturated with alum or sulphate of soda or various other salts has superior value in extinguishing fires, due to the coating it gives to objects wet with it, which prevents contact with the oxygen of the air, and thus diminishes the rapidity of the combustion.

(25) H. B. H. asks: If we take say 100 or 1,000 Winchester regular cartridges, take out the bullet and leave the powder in, or say part of the powder, and put them in a crucible to melt the metal, do you think that when the cartridges begin to get heated they will cause an explosion capable of injuring the building or the crucible? We maintain that it will not do so, but that the cartridges will discharge gradually with the heat, as it is impossible that they should all get heated at the same time. A. You will have a number of explosions, which on account of the fulminate of mercury in the shells will be almost instantaneous, or equivalent to a single great explosion, capable of doing much injury.

(26) R. S. writes: 1. The velocity of electricity is said to be 288,000 miles per second. What kind of electricity has that velocity, and what kind of a conductor should it have? A. This is the velocity of a current of dynamic electricity on the best possible conductor, suspended in air so as to avoid all dielectric action. 2. Does the entire current on a wire flow in one direction, viz., from the copper pole to the zinc pole? I think that electricity flows from the earth through the negative pole. Am I right? A. The term current is purely conventional. It is assumed to flow from carbon to zinc (or equivalently) on the outer circuit. This would make it flow from the earth to the zinc pole. 3. If light is admitted through glass of any color, the rays appear of the same color as the substance through which they have passed. They are not separated in a prismatic way. How is it that light passing through red glass will appear red? A. The true color of a body that transmits colored light is the complement of the light it transmits. A colored glass acts like a screen or sieve, and sifts out and absorbs or reflects all rays except those that pass through it.

(27) H. P. P. R. asks: 1. How many units of heat are given out in the burning of one ton of average steam coal, under conditions the same as in heating the boiler of a ship's engine? How many units of heat are given out in the combination of 2,000 cubic feet of hydrogen with 1,000 cubic feet of oxygen to form water? A. One part of carbon in burning gives off heat enough to raise 7,273 parts of water one degree C. in temperature; one part of hydrogen enough to raise 34,462 parts of water one degree C.; 2,000 cubic feet of hydrogen weigh 73,958 grains, or 10.565 pounds, at standard barometer and thermometer readings. Taking coal as representing 95 per cent carbon, one ton of 2,240 pounds would raise 15,476,944 pounds of water one degree C., and 2,000 cubic feet of hydrogen would raise 364,091 pounds of water one degree C. From these factors you can deduce heat units of any desired system. As long as the coal is completely burned, the conditions have no influence on the heat evolved. They only affect the heat collected.

(28) G. M. asks how to prepare the mercury for a barometer? Also how expel the air from the tube after it is filled? A. If the mercury is not free from other metals, it should be distilled. This is best done in an iron retort. If contaminated with dirt, it can be purified by passing through an inverted cone made of a sheet of paper containing a very small hole at its apex. Your best plan is to buy pure mercury, and not attempt to distill it yourself. The air bubbles may be gathered by introducing a clean iron wire and drawing the bubbles together with it. When they acquire a sufficient size, they will rise and escape. The air may be much better expelled by boiling in the tube, but unless experienced you will probably break the tube. The mercury for this operation should be added three or four inches at a time, and each addition boiled.

(29) H. N. B. writes: I am about making an induction coil, but would like to ask a few questions: When the core of an induction coil is magnetized by a current passing through the primary coil, the core is rendered magnetic only at the poles, and not in the middle. When the current is broken, and the soft iron core discharges its magnetism, do the magnetic lines pass from the poles only, or do they come from the middle of the core as thick as from the poles? If the middle is neutral when magnetized, I think no magnetic lines would come from the middle when discharged. Why do they wind the secondary wire all across the spool? When they come to the center, why don't they skip over that part of the core where there would be no magnetic lines, and resume the winding after they pass little beyond the middle, thus saving wire and resistance? A. The magnetic lines of force that radiate from the core of an induction coil are most numerous at the ends. Coils have often been constructed without wire in the center as you describe, but just how much is gained by this is not known. The saving is not very great.

(30) F. N. R. writes: 1. You gave a formula for a freezing mixture, viz., 5 parts nitrate of ammonia, 6 parts sulphate of soda, and 4 parts dilute nitric acid. Will such a mixture preserve the freezing properties indefinitely or for any length of time if kept inclosed in an airtight space? A. It will reach a low temperature, and maintain it for a varying length of time, according to the non-conducting power of the materials surrounding it. It cannot in your sense be preserved for future use, but must be mixed at the moment of application. 2. Will the liquid stove polish receipt given by you some time ago in your paper, viz., pulverized black lead, turpentine, water, and sugar, keep its consistency as when first made, or will it have a tendency to settle after standing a while? A. There will be a natural tendency in the black lead to settle out, and we would advise it to be shaken before use.

(31) J. P. S. says: In your issue of 26th of March, in answer to No. 17, J. W. P., you say wet the edges of the paper to overcome electrical attraction between the sheets. I run a cylinder press, and was troubled the same way. The jobs were such that I could not wet the edges. I took a large type "galley" and laid it on the delivery table, where the sheets would fall on it. A copper wire from it to the steam pipes just behind it carried off all electricity, so the sheets could be straightened easily.

(32) T. H. N. asks where he can find a full account of the composition and manufacture of aluminum bronze alloys produced by electrical methods. A. In SCIENTIFIC AMERICAN, May 22, 1886, and November 13, 1886. Also in Richards on Aluminum, very recently published, which we can mail for $2.50. [Such replies as the foregoing we usually prefer to send by mail, or at least to exercise the privilege of so doing, but there are those, whom we much regret to disoblige, who are continually forgetting to send their names and full address.—ED.]

(33) G. H. W. asks: 1. Will a cubic foot of air under pressure of say five hundred pounds be more buoyant under water than of simple atmospheric pressure? A. Air at a pressure of 500 pounds to the square inch will be less buoyant than air at normal pressure. 2. Can water be compressed to any perceptible amount? A. Water is compressed 0·00005 vol. per atmosphere of pressure (15 pounds to square inch) to which it may be subjected.

(34) A. B. asks (1) how to glue or cement German silver on to wood. A. Use the marine cement recommended in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158, under title of "Cements." 2. How to polish German silver by hand. A. Use a mixture of 1 part olive oil, 1 of spirit of sal ammoniac, 2 of lime, and 1 of water as a thick paste.

(35) D. H. asks: What fluid can be used in card writing, that will retain gold dust or bronze? A. Use gold size or albumen.

(36) W. H. B., Greenville, Tenn., asks: Can you give me a recipe for making wax to polish hickory handles with? A. Take of seed lac 1 ounce, gum guaiacum 2 drachms, dragon's blood 2 drachms, gum mastic 2 drachms, put into a bottle with one pint spirits of wine, cork close, expose to a moderate heat till the gums are dissolved; strain into a bottle for use with ¼ gill linseed oil; shake together.

(37) J. A. H. asks if there is any flux for brazing cast iron. A. We know of nothing better than borax ground in water until it assumes the consistency of milk.

MINERALS, ETC.—Specimens have been received from the following correspondents, and have been examined with results stated.

B. D. B.—The yellow substance sent is a clay, and might be available for earthenware, terra cotta, or brick making. Lignite or brown coal can be used as fuel if of sufficient purity. It cannot be accepted as an indication of better coal underneath, except in the sense that better lignite may exist below it.

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April 5, 1887,

AND EACH BEARING THAT DATE.

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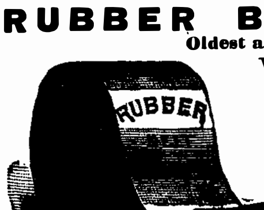

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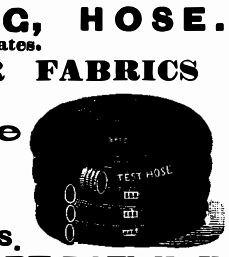

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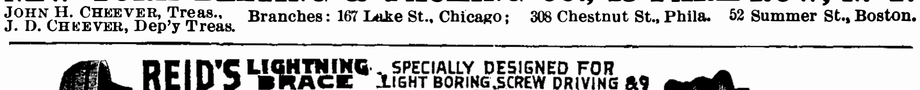

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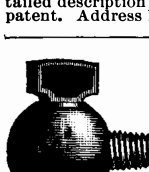

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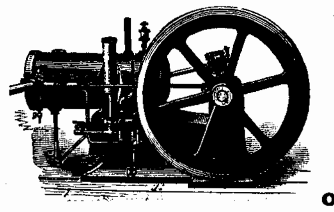

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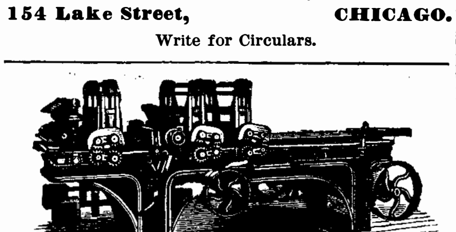

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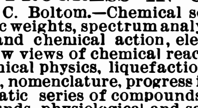

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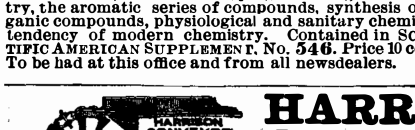

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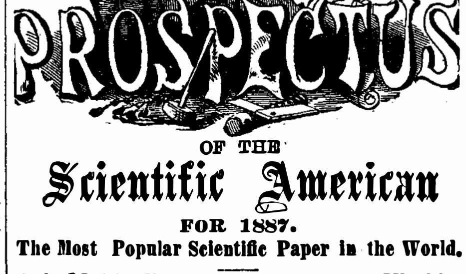

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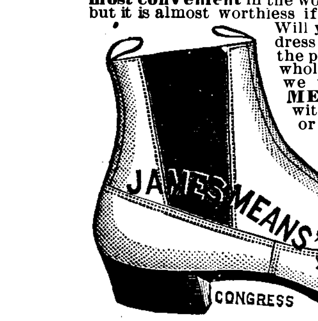

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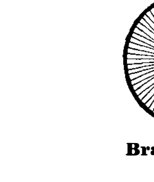

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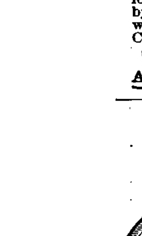

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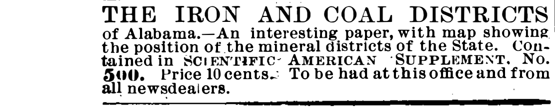

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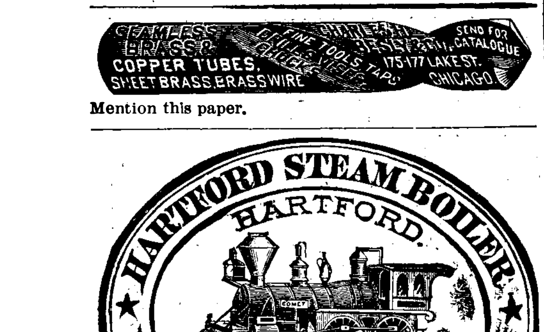

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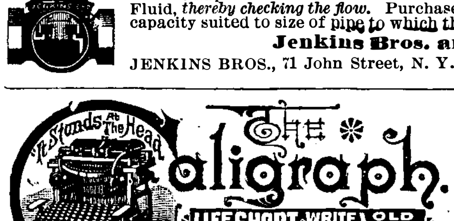

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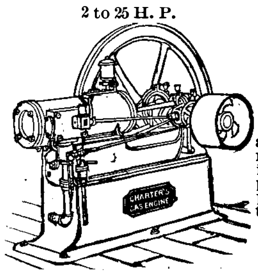

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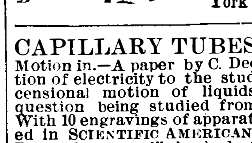

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