SCIENTIFIC AMERICAN

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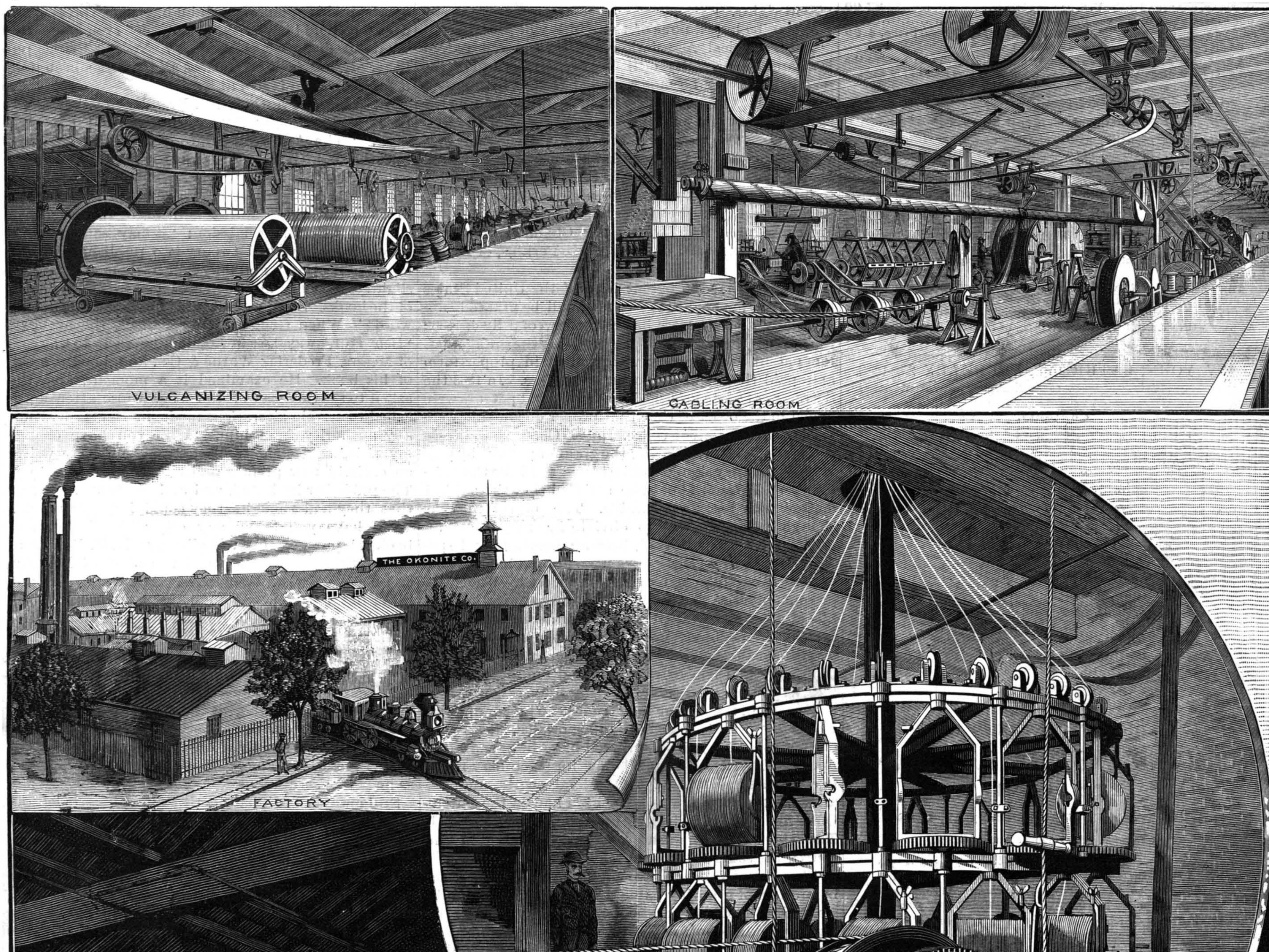

MANUFACTURE OF TELEGRAPH, TELEPHONE, AND ELECTRIC LIGHT WIRES AND CABLES—FACTORY OF THE OKONITE CO.—[See p. 115.]

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NEW YORK, SATURDAY, FEBRUARY 25, 1888.

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(Illustrated articles are marked with an asterisk.)

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For the Week Ending February 25, 1888.

Price 10 cents. For sale by all newsdealers.

AMENDMENT OF THE PATENT LAWS.

Nearly a dozen bills having in view a change in the patent laws have been introduced at the present session of Congress, most of which, if passed, would have the effect to destroy the present value of patent property and crush many of the industries that now flourish under the protection of the patent laws.

For example, bill H. R. 1,171 provides for vacating patents; 1,344, for securing public use of patents; 1,286, 1,569, 1,637, 4,368, "to protect innocent purchasers" by allowing everybody freely to infringe; 1,327, to limit the damages to be recovered by patentees; 1,431, to reduce the term of patents; 3,326, to regulate the use of patent rights.

It is to be hoped none of these bills will pass.

The Electrical Association lately discussed patent laws and the necessity of their revision, several of the members having become satisfied that changes were demanded. One of the new features proposed was the establishment of a patent court as a branch of the Patent Office. The general result of the discussion was, we believe, that the present laws worked so advantageously, it was not prudent at the present time to try to introduce any new, experimental features.

Of other suggested changes, among the most sensible are those presented by Senator Chandler, and contained in a memorial by Mr. J. McC. Perkins, of Massachusetts:

"He asks that the patent laws of the United States may be so amended that patents shall be granted substantially as they were before the law of July 4, 1836; the first patent law, of 1790, authorizing the grant of letters patent to any person who applied in proper form and paid the required government fees. In 1835 the Secretary of State informed the public that patents were issued in the order of time that proper documents were received at the Patent Office. In 1836 Congress radically changed the law regulating the grant of patents by providing that they should not be issued until the Commissioner of Patents should be satisfied that the subject matter was really patentable. The object in thus changing the law was to obviate inconveniences resulting from the fact that, because drawings and specifications in those early days were not published, some patents came to be many times duplicated. Under the present practice, however, with the publication and sale at a merely nominal price of drawings and specifications immediately upon the issue of every patent, inventors can easily ascertain whether or not it will be profitable for them to obtain patents and to undertake to enforce such patents by suits in the court, and the reason of the change made in 1836 no longer applies. Under the present system the memorialist states that the features of a judicial tribunal have been engrafted upon the Patent Office until now its machinery rivals in elaborateness that of the Federal courts, and yet after all the proceedings have been had in the Patent Office and a patent is issued, nothing has been settled. The whole question must be fought over again in the courts, the same as before the law of 1836.

"The memorialist claims that the practice prevailing before 1836 of granting patents to all applicants is substantially the English system and that of all other patent-granting countries. The memorialist proposes as his remedy for existing evils to abolish the requirement of a Patent Office examination before the grant of a patent, and to give to every inventor his patent on his filing a correct application therefor; and, if disputes arise between different inventors as to their rights, to let the controversies be settled by the courts alone, exactly as they, in fact, must be and are now settled. He states that the annual report of Judge Mason, Commissioner of Patents in 1855, presents very clearly the reasons why this change should be made; that Commissioner Foote, in his report for 1868, re-enforces Judge Mason's recommendation, and that the ablest Commissioners of Patents have repeatedly pointed out the great injustice of the present system."

If these changes were enacted, inventors would become their own examiners in respect to novelty; all delays would be done away with, an increase in the number of patents granted would take place, and the present force of examiners would be able to maintain and carry on the business of the office in the most efficient manner.

AMERICAN AND BRITISH "PIRATES."

In a pamphlet sermon entitled, "The National Sin of Literary Piracy," for which a forty-two year patent has been secured, the Rev. Mr. Van Dyke draws a rather grim picture of the American publisher who reprints foreign works; and the reader, who may be unfamiliar with the other side of the question, will scarce refrain from sympathy with the British publisher, who, by the author's inference, has so nice a moral perception that it will not permit him to indulge in the same reprehensible practices. One cannot help the regret that the author is not informed of this other side, because of his evident sincerity, for then we should have had the two pictures side by side, the American and the British publisher, and thus been able to judge of their relative merits and defects. On page 15, he says: "This nation [the American] says to the German, the Frenchman, the Englishman, 'You have written a book. We want it, and we propose to take it. You have no rights that we are bound to respect. We shall reprint your work, and mutilate it and sell it, and do as we like with it, and you shall never receive a penny for it.'"

Now, however wicked it may be to "steal" a book, how much worse it is after stealing it to mutilate it; to remove the real author's name and put another in its place, thus robbing him of all credit; to cut out chapters and replace them with others written by strange hands; to change the scene of a story, and, leaving the author's name on the title page, put sentiments in his mouth which he has not expressed and does not hold! We ask, is not this even worse than what our author calls stealing? Yet the British publisher of American books does all this—has been doing it for years, and is still at it.

An American author, Mr. Brander Matthews, who, be it said, strongly favors international copyright, says: "The American pirate only steals your purse, but the British pirate also robs you of your good name." In his recent article in the *Princeton Review*, he says: "In 1876, Longfellow wrote to a lady in England whose works had been republished in America without permission: 'It may comfort you to know that I have had twenty-two publishers in England and Scotland, and only four of them ever took the slightest notice of my existence, even to send me a copy of the books. Shall we call this "chivalry" or the other word?' When General Lew Wallace, the author of 'Ben Hur,' was last in London, he went to the store of Messrs. Frederick Warne & Co., and bought a copy of his book. He examined it a moment, and then asked to see the head of the firm, whose attention he called to certain alterations made in England without any authority from him. 'I see you have changed my title,' said Gen. Wallace, 'and you have written an entirely new preface and signed my name to it.' The publisher hesitated, and at last stammered forth that they had thought they could improve upon it. 'And have you taken any other liberties with my books?' pursued Gen. Wallace, and Mr. Warne answered that they had left out the story of Ben Hur, and made a few minor changes. And the British publisher has never offered to make any payment to the American author whom he had despoiled and whose work he had disfigured."

Dr. Holland, on a similar visit, found that Messrs. Ward, Lock & Tyler had printed one of his books with chapters condensed, rewritten, and otherwise mutilated. In another of his works he discovered a long preface by one S. O. Beeton, in which is "a note of tearful regret for John Camden Hotten, who was a very Blackbeard among British pirates, as ingenious as he was unscrupulous."

Still another book had its title altered, parts left out, and the story anglicized so as to turn a Fourth of July celebration into a loyal merry-making over the Queen's birthday. The annual list of British publishing houses abounds with American reprints, hundreds upon hundreds of them, it is said, and many, if not most of them, more or less mutilated. Nor is it an unusual thing in England to discover an American work appropriated by a foreign author. The cases are well known of the taking of Miss Wistar's adaptations from the German by the Rev. S. Baring Gould for use in what he claimed to be his own work, and again of the appropriation by the Rev. Sir George W. Cox, Bart., of the "Young Folks' Cyclopedia of Common Things," the work of Mr. John D. Champlin, Jr., an American. Hawthorne's works, some of them changed in title, as, for instance, the "Transformation" for the "Marble Faun," are found in pirated shape in all the principal English libraries, so are Dr. Holmes' works and a host of others. All British publishers do not do these things. By no means. But if there is a single American publisher who engages in such practices, we have yet to hear of him.

Normal Lectures in Science Teaching.

On February 15, at 4 P. M., the first of a series of three lectures on the above subject was delivered by Dr. T. O'Conor Sloane, in the hall of the Industrial Educational Association, in this city. The general plan of the course is to show how completely a course of instruction in physics can be illustrated with experiments performed with the most simple apparatus. The ground covered in the first lecture included properties of matter, cohesion, porosity, elasticity, impenetrability, etc., the general laws of motion and force, action and reaction, impact, centrifugal and rotary force, and the mechanical powers. A large number of experiments were given in the above subjects, very little except common, everyday objects being employed. In the succeeding lectures the remaining ground, exclusive of electricity, will be covered. The audience comprised the leading educators of the city, the public schools being largely represented by their principals and vice-principals. The dates for the next lectures are February 29 and March 14.

Comparative Wages, American and Foreign.

The following tables from the New York *Press* are stated to be reliable, and to have been complied from recent authentic sources by Mr. Alfred R. Whitney. The statements in regard to the wages paid in England are compiled from the latest returns made by the Board of Trade in London and other official documents for 1886.

It must be remembered that the cost of living here as shown by official figures is 17 per cent higher than in England.

	England.	United States.
Bookbinders	$6 00	$15 00 to $18 00
Brushmakers	6 00	15 00 to 20 00
Boilermakers	7 75	16 50
Brickmakers	3 54	11 86
Bricklayers	8 00	21 00
Blacksmiths	6 00	13 30
Butchers	6 00	12 00
Bakers	6 25	12 75
Blast furnace keepers	10 00	18 00
Blast furnace fillers	7 50	14 00
Boltmakers	6 50	16 50
Bolt cutters	3 00	10 00
Coal miners	5 88	13 00
Cotton mill hands	4 60	6 72
Carpenters	7 50	15 00
Coopers	6 00	13 25
Carriagemakers	6 75	13 00 to 25 00
Cutlery	6 00	12 00 to 20 00
Chemicals	$4 00 to 6 00	13 00 to 16 00
Clockmakers	7 00	18 00
Cabinetmakers	7 00	18 00
Farm hands	3 00	7 50 to 9 00
Glassblowers	6 00 to 9 00	25 00 to 30 00
Glass (partly skilled)	6 00 to 7 00	12 00 to 15 00
Glass (unskilled)	2 00 to 4 00	7 00 to 10 00
Glovemakers (girls)	2 50	6 00 to 9 00
Glovemakers (men)	4 50	10 00 to 30 00
Hatters	6 00	12 00 to 24 00
Heaters and rollers	10 00 to 12 00	20 00 to 30 00
Iron ore miners	5 50	12 00
Iron moulders	7 50	15 00
Iron per ton (finished)	2 00 to 3 00	5 31 to 8 71
Instrument makers	7 00	18 00 to 20 00
Laborers	4 10	8 00
'Longshoremen	8 00	15 00
Linen thread (men)	5 00	7 50
Linen thread (women)	2 35	5 22
Machinists	8 50	18 00
Masons	8 00	21 00
Printers (1,000 ems)	20	40
Printers, week hands	6 65	13 40
Patternmakers	7 50	18 00
Painters	7 50	15 00
Plumbers	8 00	18 00
Plasterers	7 50	21 00
Potters	8 67	18 30
Polishers	7 00	18 00
Papermakers	5 20	12 00 to 24 00
Puddlers, per week	8 00 to 10 00	18 00 to 20 00
Quarrymen	6 00	12 00 to 15 00
Ropemakers	5 25	9 00 to 12 00
Railway engineers	10 00	21 00
Railway firemen	5 00	12 00
Shipbuilding:		
Boilermakers	7 00	14 00
Machinists	7 00	14 15
Coppersmiths	6 50	16 50
Platers	8 00	18 00
Drillers	6 00	12 00
Riveters	8 00	17 40
Riggers	5 50	11 00
Patternmakers	8 00	24 00
Saltmakers	6 00	9 00 to 10 50
Silk (men)	5 00	10 00
Silk (women)	2 50	6 00
Scarfmakers	1 50 to 2 25	6 00 to 9 00
Servants (month)	5 00	15 00
Shoemakers	6 00	12 00
Stationary engineers	7 50	15 00 to 18 00
Soapmakers	5 00	10 50
Tanners	5 00	8 00 to 10 00
Teamsters	5 25	12 00 to 15 00
Upholsterers	8 00	18 00
Watchmakers	8 00	18 00
Wire drawers	11 00	22 00

WOOLEN GOODS.

Below is a table showing the average weekly rate of wages paid in woolen factories in the United States (Massachusetts), France (Rheims district), England (Yorkshire district), and Germany (Rhenish district). It is impossible to doubt the accuracy of this table, as Carroll D. Wright is responsible for the United States figures, ex-Consul Frisbie for those of France, Robert Giffen for the English, and ex-Consul Du Bois for those of Germany.

Occupation.	United States.	France.	England.	Germany.
Wool sorters:				
Men	$9 43	$5 82	$5 76	$5 50
Women	6 00	2 70	2 40	2 50
Young persons	5 12	2 00	1 80	1 90
Spinners:				
Men (overseers)	12 00	6 50	6 00	6 60
Spinners	9 05	6 00	5 00	5 25
Women	6 18	3 00	3 00	3 00
Young persons	4 81	2 00	1 80	1 90
Piecers	5 00	3 00	2 50	2 40
Weavers:				
Men	8 53	4 67	4 80	4 25
Women	7 45	4 00	3 48	4 00
Mechanics	13 40	6 25	5 50	5 00
Laborers	3 58	3 75	3 35	3 00

According to official authority, wages are 100 per cent higher in the woolen and worsted industry in the United States than in any of the European countries.

WORSTED GOODS.

Relative actual cost of labor in a woolen mill of 221 hands in Providence and of a similar mill in Bradford, England, according to Mr. Charles Fletcher:

	Providence.		Bradford.	
	Per week.	Total.	Per week.	Total.
45 small boys and girls, 14 years old	$3 25	$146 25	$1 50	$67 50
104 small boys and girls, 18 years old	5 25	546 00	2 50	260 00
50 boys and girls, 21 years old	6 00	300 00	3 00	150 00
6 section hands	13 50	85 00	7 00	42 00
2 overseers	24 00	48 00	9 00	18 00
1 superintendent	36 00	36 00	15 00	15 00
1 boss dyer	30 00	30 00	10 00	10 00
8 laborers in dye house	7 00	56 00	4 50	36 00
1 watchman	14 00	14 00	6 00	6 00
2 machinists for repairs	15 00	30 00	7 50	15 00
2 clerks	15 00	30 00	7 00	14 00
Total cost of weekly pay roll		$1,317 25		$633 50

107·93 per cent in favor of Providence operatives.

Diffraction of Sound.

Lord Rayleigh, F.R.S., lately lectured at the Royal Institution on "The Diffraction of Sound," and performed remarkable experiments bearing relation to the analogy between the phenomena of sound and light.

He stated that sound shadows are not sharp, but sharper than is generally supposed; because, in passing round a hill, a little time is necessary to realize the difference in intensity of a sound thereby shadowed. The indicator in his experiments was, he said, one of the sensitive flames to which Dr. Tyndall had devoted so much attention, and which were most sensitive to extremely high notes; indeed, Professor Barrett and himself—Lord Rayleigh—proved about the same time that the notes to which they were sensitive were near the limits of audition. The sound he would use that evening was not audible to the human ear, and was produced by air issuing steadily through a small orifice. It would throw shadows several feet long. The length of the sound waves to be used was about half an inch of complete wave length. Sound waves were usually much longer, for instance the wave length of middle C was 4 feet. Every solid body, he remarked, is an almost perfect reflector of sound. On holding a wooden disk at different angles behind this sensitive flame, burning at three or four feet from the source of sound, the reflected sound had an influence upon the flame even when the disk was a yard behind. Tissue paper and glass reflectors had a similar influence. The waves of sound consisted of what were called loops and nodes. The flame was excited by the loops and became quiescent in the nodes. A peculiarity of the phenomenon was that the flame was not uniformly sensitive—that is to say, that when sensitive to the east and west, it was not sensitive north and south, all other conditions being the same. The flame could be excited by a small mirror a yard off, and the mirror would produce diffraction phenomena, because a small mirror in sound was analogous to a small hole in optics. By placing the reflector at certain distances behind the flame, the following results in maxima and minima of disturbance were obtained:

Table of maxima and minima in centimeters.

Maxima.	Minima.
1·1	
4·5	3·0
7·5	5·9
10·3	8·9
13·0	11·7
15·9	14·7

In one experiment he interposed a glass screen with a large hole in it between the sound and the jet, and the flame was quiescent. The hole was about the size of a dinner plate. When he diminished the size of the hole the flame began to flare. The same took place when he inserted a disk smaller than the hole, leaving an annular air space. He said that when Fresnel strongly advocated the then unpopular wave theory of light, a French mathematician opposed to the theory proved that if Fresnel were right, an opaque disk placed under certain conditions in a beam of sunlight, instead of throwing a complete shadow, would throw one with a bright spot in its center, thus reducing the whole matter to a *reductio ad absurdum*, as he thought, but Fresnel, nothing daunted, fitted up the necessary apparatus, and proved that under such circumstances there actually was a spot of light in the middle of the shadow. The experiment may be performed by means of a threepenny bit suspended in a dark room in a beam of sunlight admitted into that room through a small hole; the shadow thrown should be received upon a piece of ground glass and examined. The analogue of that experiment in optics he would exhibit before them in sound.

Lord Rayleigh then took a disk of glass about 15 inches in diameter and suspended it in a carefully regulated position between the source of the sound and the sensitive flame. The sensitive point of such flame is just where the gas issues from the burner, and when the sound analogue of the spot of light fell at that point from the interposition of the disk, the flame began to flare; the slightest motion of the disk from the proper position would stop the flaring. By moving the disk at right angles to the direction of the sound, other positions which caused flare were revealed, proving that the disk was producing a series of sound rings. He then took a sheet of zinc about 18 inches in diameter, out of which a series of concentric rings had been cut, and when this was placed across the path of the sound waves, the flame flared more than when no obstruction intervened; in fact, he stated the zinc grating acted as a lens did in optics—it concentrated the sound.

Filaria Immitis Found in a Dog.

BY F. W. SCHLEPEGRELL, A.M.

In February, 1884, a favorite dog, one of the coach variety, was found lying in a comatose condition, without having shown any previous symptoms of disease. This condition, in the course of a few hours, was succeeded by convulsions and death. The symptoms being somewhat similar to those exhibited in cases of dogs poisoned by strychnia, an examination was instituted which developed the remarkable fact that the right ventricle of the heart was filled with nematode worms. We counted thirteen in number, ranging from eight to thirty-three centimeters in length.

The presence of such an obstruction in the heart explained fully the symptoms observed and the result, but we were unable to understand how these parasites had found their way into the heart, as we supposed that they belonged to the alimentary canal, and that they could have been in the heart but a short time. Another surprising circumstance was that but few worms were found in the intestines, and those of small size compared to those found in the heart.

Unable to find a satisfactory explanation, we sent a statement of the above facts to Messrs. Munn & Co., editors of the SCIENTIFIC AMERICAN, who took great interest in the case, and gave us, in substance, the following particulars:

That our statement was of interest, as, in this country, cases such as we described are fortunately rare. In China, however, this is not the case. Hundreds and even thousands of dogs die in the same diseased condition. The entozoon which we described was doubtless one of the nematode blood worms, and not an inhabitant of the intestines. The species so fatal to dogs in China and Japan is often appropriately called the "cruel threadworm." It is the *Filaria immitis*. Some writers refer it to *Spiroptera sanguinolenta*, but Cattold says that that species "does not gain access to the blood vessels." Dr. Lamprey says that "the hearts of dogs at Shanghai are invariably found to contain these entozoa." The dogs sometimes die suddenly in a fit, and some linger long in great pain.

They concluded their interesting letter with the statement that the entozoa which we had found were of interest on account of the unusual size attained (33 centimeters), as the usual length was only 10 to 12 centimeters.

Having gained this information, we made a microscopic examination of a female *Filaria immitis*, which we had found in the heart, and found the oviducts crowded with eggs and embryos in all stages of development. We also made a special examination of the blood with one of the higher powers of the microscope (400 diam.), and found it crowded with the bodies of parasitic animalcules. In our examination we found only the fully developed worm, which, with the embryos observed in the oviducts of the *Filaria immitis* examined, convinced us that they are reproduced viviparously, and that the young are afterward carried along in the circulation.

In seeking for the origin of this diseased condition of the dog, we learn that in India, where this disease is most prevalent, it is supposed that the animals may have obtained their parasites from the ova of Ascarides passed by man. It has been asserted that human excrement forms the principal food of dogs in China and India. Presuming the possibilities of the development of the *Filaria immitis* from the ova of the *Ascarides*, this would account for the great prevalence of the disease in those countries.

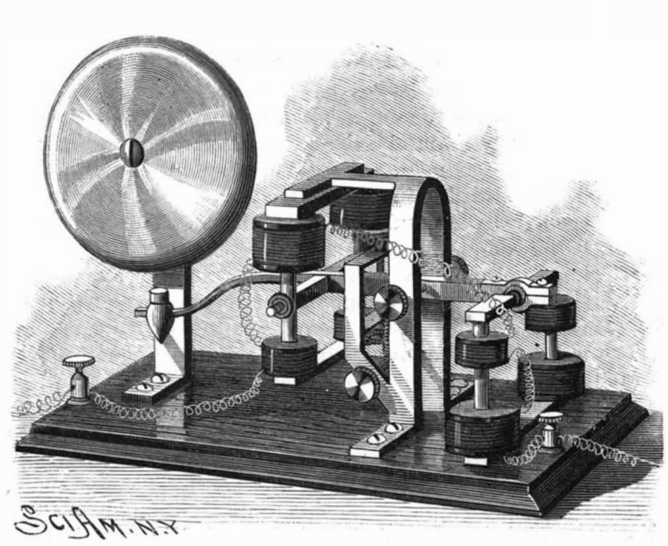
Dr. Lamprey thinks that the presence of this hæmatozoon is only prejudicial to the canine bearer when the animal is suffering from some other cause, and cites a case where a dog was killed and found to contain over 200,000 of these minute worms, without having previously developed any symptoms of uneasiness. This, however, appears very improbable. In the case, for instance, which came to our notice, the dog evidently died from the effects of the parasitism.—*Proceedings of the Elliott Society.*

Hollow Masts.

There has been an official inquiry into the loss of the British ship Athelstan, which was burned from the spontaneous ignition of her cargo of coal. According to the account given by a London contemporary, during the time the fire was confined below the deck, the captain and chief mate were surprised to find flames issuing from the tops of the iron fore and main masts, which were hollow, and had a number of perforations in them below deck for the purpose of ventilation. They operated like two chimneys, to make a furnace of the ship's hold.

AN IMPROVED ELECTRIC BELL.

An electro-magnetic bell in which a long stroke of the bell hammer may be obtained, to produce an effective alarm without the employment of spring or weight mechanism, has been patented by Mr. William F. Stocker, and is illustrated herewith. Combined with a bell hammer lever, pivoted in a frame of special construction, are one or more electro-magnetic armatures and one or more helices adapted to receive the armatures within their coils, either the armatures or the helices being carried by the bell hammer lever. By providing a long stroke of the electro-magnet or polarized armature, a powerful blow of the hammer upon the bell is obtained, and as the device is designed for heavy work, it is desirable to place it in a local circuit provided with a strong battery, operating the local circuit by means of a relay.

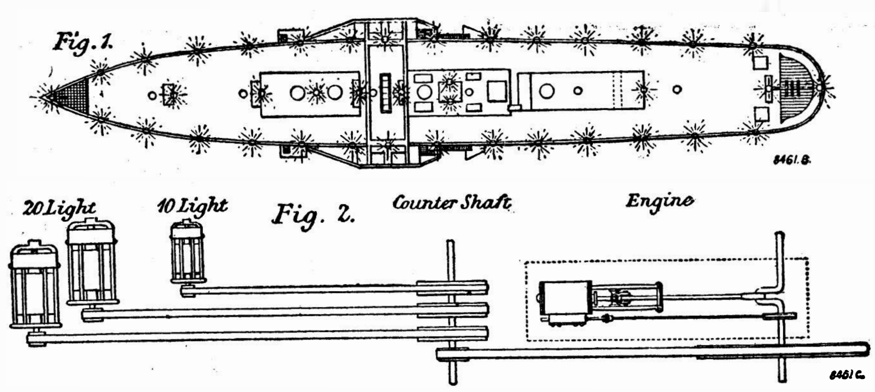


STOCKER'S ELECTRIC BELL.

For further particulars with reference to this invention address Mr. W. O. Van Arsdale, Burrton, Kansas.

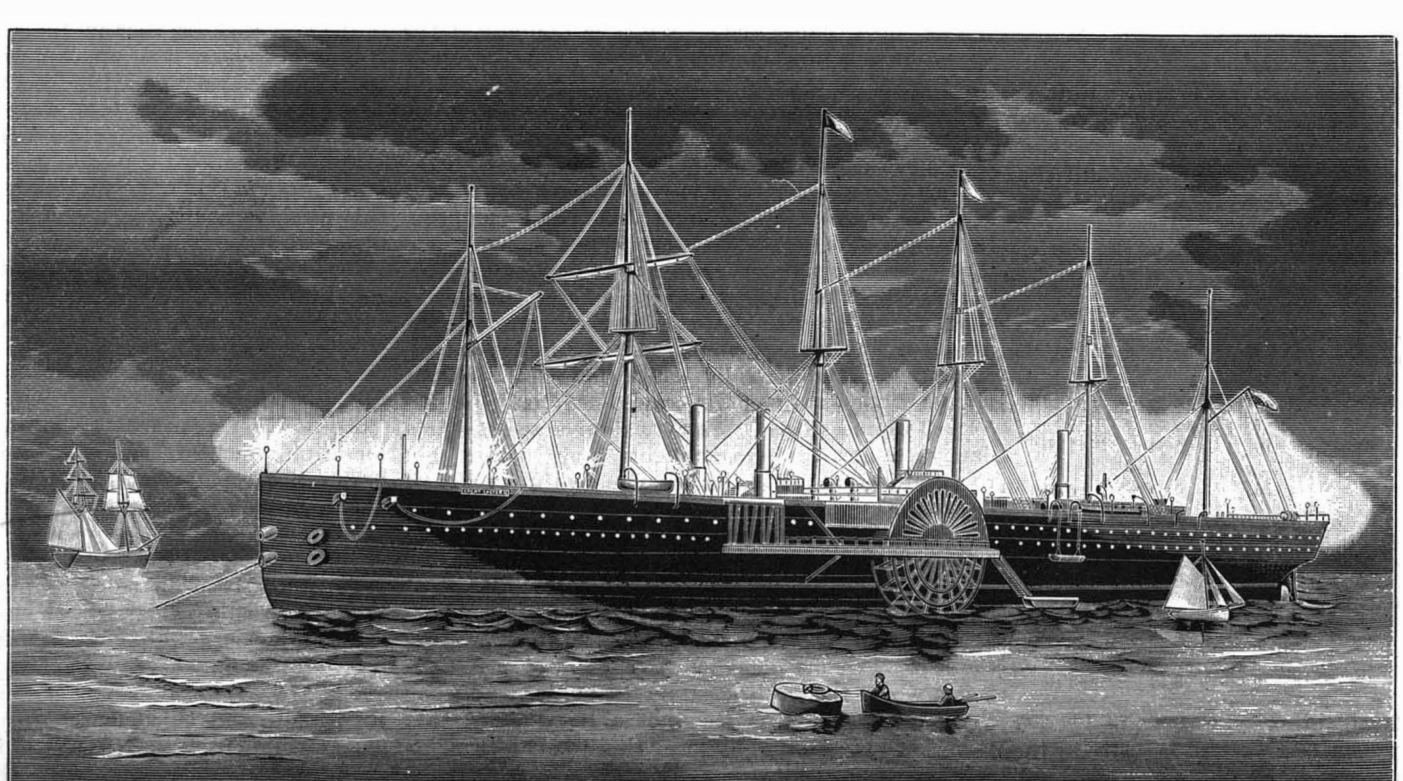
ELECTRIC LIGHTING OF THE GREAT EASTERN.

The Great Eastern steamship, which played such an important part in the early days of submarine cable work, and whose career seems now to be at an end, was, says *Engineering*, recently fitted with a larger number of arc lamps than has hitherto been placed on shipboard. The vessel was chartered by Messrs. Lewis & Co., of Liverpool, for the purpose of exhibition and as a place of popular entertainment during the summer of 1886, and she has since, in other hands, been anchored in Gare Loch, at the mouth of the Clyde, fulfilling a similar purpose. The vessel is fitted with forty-five simple Jablochkoff arc lamps, thirty-nine of which are arranged on deck as shown by the illustrations, the remainder being between decks, lighting the forward tank, the ball room, the grand saloon, and the main deck, which is utilized as a theater.



The engine rooms have recently been lighted by electricity, one arc lamp being suspended in each. The vast improvement effected over the oil lamps originally used is much appreciated, as is the lighting of the ship generally. When lit up, the appearance of the vessel is very effective, and on board, the decks can be viewed as well as by daylight.

Fig. 2 shows the arrangement of the dynamos, of which there are three—Gramme type. They are placed two decks down, over the after end of the screw engine room. Two of the machines are capable of lighting twenty lights each, thirty-five to forty being the number generally in use at one time, while the third, which is in reserve, has capacity for ten lights. The engine used for driving the above is of the ordinary horizontal single cylinder non condensing type, and is supplied with steam power from a locomotive boiler.



THE ELECTRIC LIGHTING OF THE GREAT EASTERN.

The Atlanta.

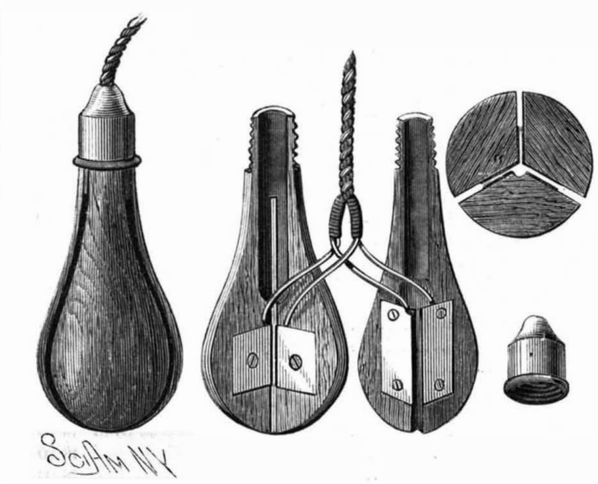
The Philadelphia *Inquirer* says: "Those friends of the late John Roach, and their name is legion, who remained steadfast in their belief in his skill as a shipbuilder in spite of the persistent attacks made upon him in connection with the four vessels built for the government, have at last practical proof that their confidence was not misplaced. The Atlanta, the best abused ship of the quartet, has been put to a test which few vessels belonging to the navies of Europe would have come through so triumphantly. The Atlanta has been bumped ashore with more than ordinary violence. The fact of her having come off without cracking her plates or starting a rivet is a practical proof that John Roach put good material into his ships. The naval advisory board, which superintended the construction of the four Roach ships, has now orders to close up all work on those vessels, which shows that the government is satisfied that they meet the requirements of the service. One of the prognostications regarding the Atlanta was that 'if she touched the ground and the water only left her six inches, something would be sure to break, either a frame or a bracket plate, from the inherent weakness of her construction.' A great deal was made about the report of Captain Bunce regarding the inability of the vessel to stand the repeated shocks of the explosion of her heavy guns, but it was afterward proved that the slight derangement of some of the interior fittings after the firing was quite local and had nothing whatever to do with the strength of the exterior hull."

The Nearest Star.

The distances of the stars are ascertained in the same manner as those of the sun and planets; that is, by parallax. Instead, however, of taking two stations at different parts of the earth's surface, and laying down a base line between them, we take the diameter of the earth's orbit, or 183,000,000 miles, as the base; the observations being taken at intervals of six months. Even with this immense line, however, the parallax is so small that it can only be detected by the most careful observations and accurate instruments. The parallax of about a dozen stars has now been ascertained, and is found to vary between 0·919 second and 0·046 second. The star α Centauri is the nearest to the earth, and its distance is estimated at 20,496,000,000 miles; while the average distance of stars of the first magnitude is probably three or four times as great as this.

AN IMPROVED ELECTRIC CIRCUIT CLOSER.

A pendent circuit closer, designed to close the circuit with certainty whenever it is grasped by the hand, has been patented by Mr. William F. Stocker, and is illustrated herewith. It consists of a handle of non-conducting material divided longitudinally into three equal parts, each part carrying a plate connected with one of the electrical conductors, the smaller ends of the three sections being confined by a ferrule, so as to allow the free ends of the sections to spring when pressed by the hand. The central figure is a side elevation of the sections of the handle separated from each other to show their electrical connections, the small figure illustrating the ferrule, and another sectional view showing how angled metallic plates are fitted in the main part of the handle section, from which the conductors lead. The arrangement is such that when any two of the sections of the handle are brought together, the electric circuit will be closed between two of the angle plates, thus permitting of using this circuit closer without giving any attention as to how it is grasped in the hand.



STOCKER'S ELECTRIC CIRCUIT CLOSER.

For further information relative to this invention, address Mr. W. O. Van Arsdale, Burrton, Kansas.

Heavy Guns Abroad.

In Europe all the very large cannon are wrought or built up, but we are trying the experiment of casting the steel gun whole, a very much cheaper and more expeditious process. One such gun has been cast in Pittsburg, and to all appearance it is a success, but it has not yet been tested. Should it stand the test of the trials, says the *Real Estate Record and Guide*, of this city, it will mark a great advance over Europe in the making of great guns. Our ordnance officers think that the gun of the future will be made of aluminum bronze. It will be very much lighter, stronger, and cheaper than the steel gun. And then the bronze itself will have a far higher value than old steel. Aluminum, it must be remembered, is the metallic basis of all clay soils. This metal has some very remarkable properties. It is almost as light as glass, it does not rust, it is stronger than steel, and with alloy can be made to replace any of the other metals. It is not in universal use because of its great cost, but science is at work solving that problem. Its use for guns and firearms would revolutionize modern warfare.

MUCILAGE of acacia, made with acetic acid in place of water, makes a good liquid cement. It cannot be used for marble.

MAKING INSULATED WIRES FOR ELECTRICAL USES.

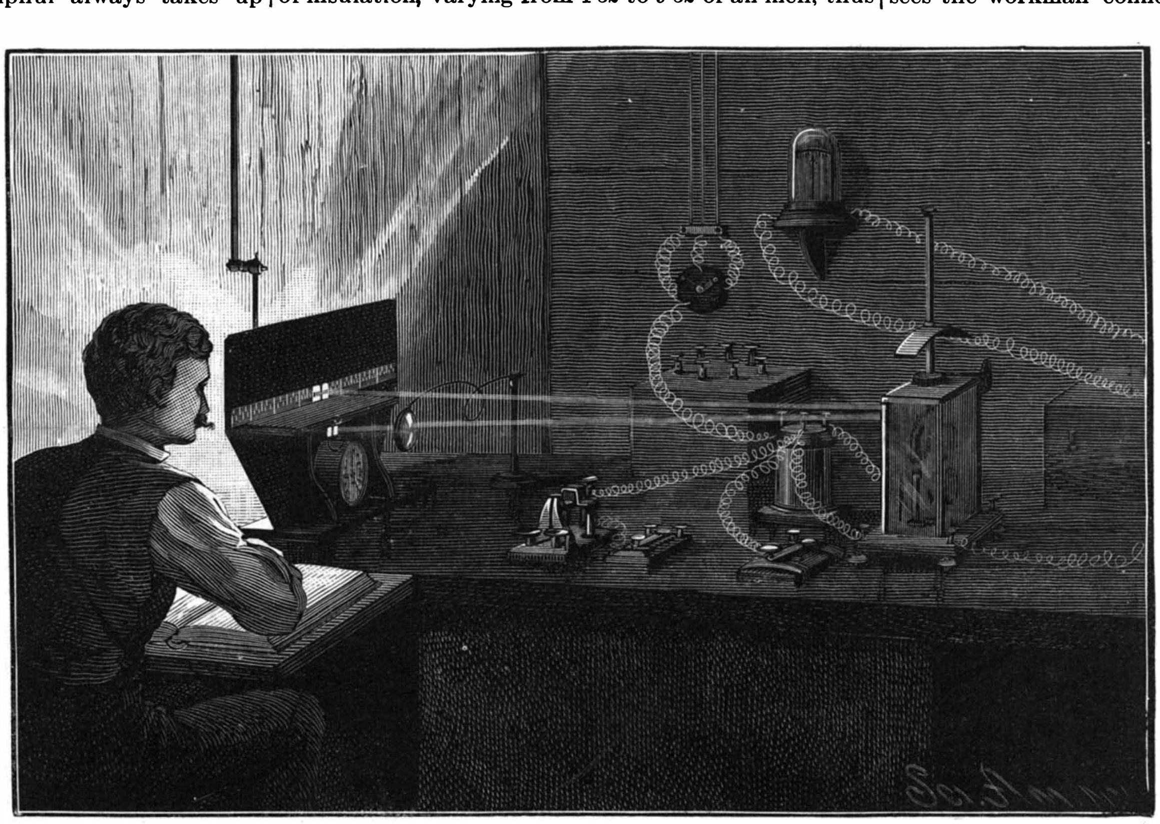
The number of extensive industries which have been developed within a very recent period, growing out of the improvements which have brought electricity into such common use, is something remarkable. An industry of this kind is portrayed in our first page illustrations, representing the factory and different departments of the Okonite Company, of New York, for the manufacture of telephone, telegraph, and electric light wires and cables, for aerial, submarine, and underground use.

The firm name is that of the compound used in covering the wires, a composition which is the result of a long series of experiments and tests to obtain something which, with superiority of insulation, would have great durability, toughness, and resistance to the decomposing influence of the elements. In its composition and manufacture the processes followed are somewhat similar to those employed in the making of vulcanized rubber products, such as belting, hose, etc., in which, according to the article to be made, the rubber is mixed with different ingredients, in varying proportions, which the manufacturers have proved of value in their long experience, but the knowledge of which they retain as among the secrets of their special trade, being the result of something over thirty years' experience with the compound. In the manufacture of okonite, however, still different ingredients are used, which give it an exceedingly high insulation resistance, equaling, if not surpassing, the best gutta-percha.

As in the manufacture of vulcanized rubber, it is even more important in making okonite that the sulphur used should be free from acid, and from the moisture which acid sulphur always takes up rapidly on exposure to the atmosphere. Great care is taken in this particular, all the sulphur used being carefully tested, and the mixtures to be worked into the rubber being accurately weighed. The working of the raw rubber, from the first step in its cleansing up to and through the mixing machines and the calenders, is a labor requiring great thoroughness in every detail, and the employment of a great deal of powerful machinery, for it must be worked through and through the different machines many times in order to secure the most intimate mixture and exclude all bubbles and prick holes. These operations, however, are only those incident to the usual manufacture of vulcanized rubber, except that the large rolls of rubber-like prepared okonite, rolled to a thinness ordinarily less than that of a sheet of blotting paper as they come from the last calendering machine, must be of the most perfect manufacture. These strips are usually about three feet wide, and are rolled up with a thickness of duck to support the thin sheet of okonite and prevent its surfaces from sticking together, these rolls being then taken to the wire-covering room, shown in one of our views.

As the okonite is put on the wire before vulcanizing, being then vulcanized in position, a perfect evenness of covering being necessary, an ingenious method of manipulation has been devised for this end. On one of the long tables in the covering room are smoothed out long strips of thinly rolled pure tin, some fourteen inches wide, which are brushed over with a sort of thin varnish, to insure perfect freedom from any dust or dirt, and to prevent the okonite from sticking to the tin. Over these strips the okonite is rolled out to entirely cover the tin, to the size of which it is trimmed, and make a long, smooth band of thin okonite, with a thin tin backing. These bands are then drawn through a cutting machine, by which they are cut into narrow, tape-like strips, and automatically wound upon a reel with many divisions, each tape-like section into its especial division. Thus prepared, the tape-like sections being afterward joined at their ends as the whole are placed on a single reel, the okonite is ready for use in covering the wire. The reel carrying the tin-backed narrow strip of okonite, its width and the thickness of okonite being dependent on the size of wire to be covered and its intended use, is then mounted to feed out in connection with another reel or drum carrying the wire, these reels being located at some distance from the covering machines, so that the wire and covering may be allowed to feed without appreciable tension. At the covering machine they come together and pass through dies, the wire being thereby so thoroughly wrapped around by the okonite and its tin backing as to make the covered wire look like a wire of tin of several sizes larger, so perfect is the covering. The necessity of doing this work thoroughly is obvious when it is remembered that the now covered wire has yet to go into the vulcanizing oven, where it is subjected to a temperature of 275° F. for an hour, the heating being effected by turning the steam directly into the vulcanizers. Any flaw in the tin covering of the okonite would thus be likely to cause pricks or other defects in the okonite. In one of the views may be seen a representation of these vulcanizing chambers, of which there are several of various sizes in the factory, and the large drums in the foreground, on which the wire is wound as it comes from the covering machine, these drums being mounted on low carriages so that they can be conveniently moved about the floor, or rolled from their carriages into the vulcanizing chamber.

After vulcanization, the tin covering or wrapper has to be removed from the okonite-covered wire, and this is effected by passing it through a stripper, the operation, as well as that of covering, being effected with a rapidity which hardly seems possible until one has seen it actually accomplished, each conductor, whether it be for a single line wire or one of even hundreds of conductors in a large cable, being thus thoroughly and evenly covered with a strong and durable insulating covering. The company afford any size of wire or insulation, although they use a standard of regular thicknesses of insulation for the usual sizes of wire, as, for instance, No. 18 wire, according to the Birmingham wire gauge, is furnished with six different thicknesses of insulation, varying from 4-32 to 9-32 of an inch, thus giving a wide variety of goods for customers to select from in all the regular grades.



TESTING OKONITE INSULATED WIRE.

The wire, having been provided with its insulating covering and tested, is ready to go either to the braiding room, the fireproofing room, or the cabling department. The company make silk or cotton braided lamp cord, and all similar goods, with double conductor twisted or braided parallel, and flexible cords and cables with any number or size conductors for elevator and analogous uses.

The company makes also a less expensive aerial wire, known as the Candee aerial wire, which has given such universal satisfaction that it has required the placing of a great number of new braiding machines within the last three months. The wire after having been braided is then to the treating room, where, after treatment in their special compound, it is returned for an additional braid and again treated, thus insuring a thorough saturating of the braid ; after this is completed it is sent to the polishing room, when it is ready for shipment.

In the cabling room shown in one of the views are small machines for putting several conductors together in one wrapper, and larger machines for uniting these several strands as it were in a large cable. The strands are fed from spools or reels through apertures in a revolving disk or plate, the reels having a double motion, so that the wires will not be twisted as the cable is formed, the conductors being covered with an extra insulating wrapper and then strongly bound together as the operation proceeds with an insulating material composed of two or four layers of strong tape, with okonite composition between the same, to protect it from injury during handling and use, and an additional protection from dampness or water.

When the cables are to be armored, as is the case in the work for electric light, submarine use, and submarine telegraph cables, where many conductors are cabled together, they are covered with a packing of jute cord to protect the armoring wires from injuring the conductors before being sent to the armoring room. The large machine here used is adapted to put around a cable any number of strands of galvanized wire which may be required, the number actually used ordinarily varying from fourteen to twenty-five. The wire is held on spools, revolved by gear wheels, as the machine revolves, the cable passing up through a die plate in the center, through which also passes the armoring wire, being firmly twisted around the cable by the rotation of the machine, while the revolution of the wire-holding spools prevents the twisting of the wire itself. As the cable is armored, it passes over suitable pulleys and is wound directly on large drums, in convenient form for shipping, these drums with their load of cable sometimes representing a weight of several tons each.

Perhaps the most important consideration of all, however, to a customer purchasing such insulated wire, is the question as to the absolute perfection of the insulation. Of this fact, which might be very readily doubted by one who had only gone thus far through the process of its manufacture, it is only necessary to inspect for a few moments the work of the testing room, where all the wires and cables are tested, to be abundantly satisfied. In this room are two of Thompson's reflecting galvanometers with an expert operator, there being just outside the room large tanks of water, convenient to a table to which the coils of wire to be tested are brought, and placed in water and allowed to remain three days. The operator sees the workman connect the coil with the instrument, and then determines the resistance of the wire. If there be any defective spot in the insulation, the current is short-circuited by the water and the defect at once noted by the instrument, its exact location being found on slowly withdrawing the coil. In testing cables after the conductors are all put together, the operation is proceeded with in more detail, according to well known methods of charging the wires for a minute or so, the system being so perfect that any fault can always be definitely located within a few inches.

For making connections and splices, the company manufacture a special okonite tape, which is a thin tape of okonite with a slight cloth backing. The latter is only employed to separate the layers, and must be removed before using, when, the joint being cleaned, the okonite is pressed well over it, and a little heat, as from a lighted match, applied, thus making a joint which is thoroughly waterproof and a perfect insulating medium.

The tenacity and toughness of okonite, rendering it non-liable to destruction by reason of abrasion or rubbing, and the fact that it is not susceptible to extreme ranges of temperature, have made this insulator highly popular among all users of electrical supplies, and the company have the highest indorsements as to its value from many of the largest users of insulated wire here and abroad. Okonite wire has been subjected alternately to a temperature of 20° below and 350° above zero, the tests being repeated a number of times, the result showing no apparent change in the quality of the wire.

Recent tests made by the United States government of okonite No. 16 Birmingham wire show an insulation resistance of 2,000 megohms per mile. A report from Capt. A. E. Black, commanding submarine defenses of the Clyde, Scotland, while giving many specific details, says. "We have found the coating to stand a great deal more rough handling than other wires which have come under our notice; in fact, seems to equal, if not surpass, the best gutta-percha wire." An exceedingly favorable report was also received, concerning tests at Portsmouth, England, from the Lords Commissioners of Admiralty, while Commander Goodrich, inspector of ordnance at the torpedo station, Newport, R. I., states as follows in regard to hot air tests : "A piece of okonite wire being suspended in the air over a steam boiler, leaving it untouched for a month, showed an insulation resistance at the end of the time too great to measure, approximating 3,500 megohms per mile." Mr. George A. Hamilton, electrician of the Western Union Telegraph Co., having tested several thousand miles of okonite wire, says:

"I have yet to learn the first case of deterioration of the core that has passed under my inspection."

Among the larger users of okonite cables are the following:

Western Union Telegraph Co., all parts of the country, New York; New England Telephone and Telegraph Co., Boston; Metropolitan Telephone and Telegraph Co., New York; Delaware and Atlantic Telephone Co., Philadelphia; New York and New Jersey Telephone Co., Brooklyn; Bell Telephone Co. of Canada, Montreal; City of Brooklyn; Thomson-Houston Electric Co.; City of Cleveland, O.; City of Chicago; Underground Electric Light and Power Co., Philadelphia; United States Torpedo Station, Newport, R. I.; Commercial Cable Co., New York, and many others, including most of the licensees of the American Bell Telephone Co.

Mr. Charles A. Cheever is the president and Mr. Willard L. Candee treasurer of the Okonite Company, whose general office and storeroom is at No. 13 Park Row, New York, the factory we illustrate being at Passaic, N. J.

Aluminum in Flowering Plants.

At a recent meeting of the scientific committee of the Royal Horticultural Society, Professor Church called attention to the apparently general presence of aluminum in flowering plants. He said it was known to exist in the Lycopodiaceæ; it had been shown by a Japanese chemist to be present in the Japanese lacquer tree (*Rhus vernix*), and it had been found by himself in cherry tree gum, gum arabic, tragacanth, etc.; it had been stated also in the *Analyst* for January to be invariably present in the gluten of wheat in the form of phosphate. Professor Church assumes that it is probably absorbed accidentally by the roots, and that it plays no part in vegetable physiology.

Motive Power by Compressed Air.

M. Victor Popp is making good progress with his system of distributing compressed air for motive power purposes. The works for compressing the air in the Rue St. Fargeau, at Menilmontant, are of considerable magnitude. They cover an area of 15,000 square meters, of which an extent of 2,000 meters is roofed over. There are already fixed and in operation seven steam engines of 400 h. p. and two of 100 h. p. each, a total of 3,000 h. p. The conduits have already been laid over the whole area comprised between the line of the boulevards and the Rue de Rivoli. These are sometimes laid in trenches cut for the purpose, and sometimes in the sewers. The total length of pipes laid was, at the end of last December, a little over thirty miles. This source of power is used for working electric light machinery in a large number of establishments, among which may be mentioned the Cafe-Americain, the Cafe de Paris, the Cafe Anglais, the offices of the *Figaro*, and the Jardin d'Hiver.

A CHAIR FOR OUT-DOOR USE.

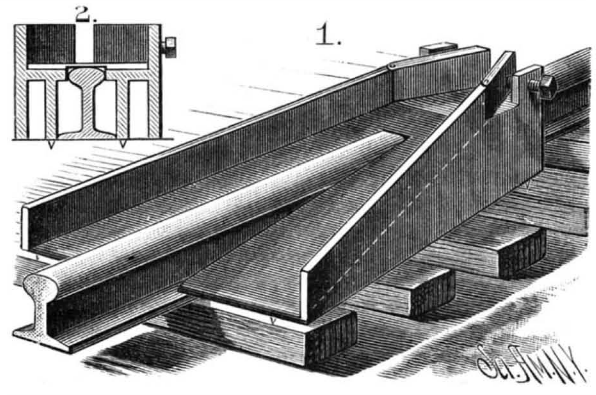
A chair which may be conveniently moved from place to place, and wherein the occupant may be protected from sun and wind, or may throw the chair open at top and sides at will, has been patented by A. Bunn, of Birdsborough, Pa., and is illustrated herewith. The

BUNN'S COVERED CHAIR.

curved side pieces constitute the legs of the chair and support the frame, being secured together by cross pieces, which support the seat. The front is inclosed from the seat to the bottom, and is fitted with a foot rest, which may be withdrawn. The side walls have openings to serve as windows, and have sliding panels, and there is a sliding top corresponding with the curved top of the chair. The chair is mounted on wheels to facilitate moving it from place to place, a pin fitted in the frame being adapted to engage with the wheel spokes, to prevent the chair from moving of its own accord when placed upon an inclined surface.

AN IMPROVED CAR REPLACER AND PORTABLE SWITCH.

A simple and durable appliance for replacing on the tracks derailed cars or locomotives, or for transferring them from a main track to a spur track, has been patented by Mr. Thomas Holliday, and is illustrated herewith, Fig. 2 being a cross sectional view. An upper plate is supported by two outer plates at about the height of the tread of the rail above the ties, the outer plates flaring outward and inclining downward as they recede, interior plates being also arranged under the first named plate, and inclining downward. To the upper inclined edges of the two pairs of plates are secured top plates having flanges on their outer edges, which are continued at their upper ends by adjustable deflect-



HOLLIDAY'S CAR REPLACER AND PORTABLE SWITCH.

ing plates, arranged in connection with set screws, by which they are moved toward or from a central space between the edges of the plates, just wide enough to admit the tread of the rail. That the device may be held against accidental displacement when adjusted, downwardly extending spurs are arranged at one or both ends of the replacer. In replacing a derailed car the device is applied just in advance of the wheels of the car, the construction permitting the car to be replaced from either side of the track and guided properly to the rails by the deflecting plates.

For further particulars in reference to this invention address Mr. Thomas M. Murphy, Sanborn, Dakota Ter.

Cobwebs and how they are made.

Every one has noticed the cobwebs which hang upon each shrub and bush, and are strewn in profusion over every plat of grass on a fine morning in autumn; and, seeing, who can have failed to admire? The webs, circular in form, are then strung thick with tiny pearls of dew, that glitter in the sun. No lace is so fine. Could any be wrought that would equal them in their filmy delicacy and lightness, it would be worth a prince's ransom. But for such work man's touch is all too coarse. It is possible only to our humble garden spider, known to scientific people by the more imposing name *Epeira diadema*. These spiders belong to the family of *Arachnidæ*; and the ancients, who were great lovers of beauty, observing their webs, invented the pretty fable of Arachne.

Arachne was a maiden who had attained to such expertness in weaving and embroidering that even the nymphs, leaving their groves and fountains, would gather to admire her work. They whispered to each other that Minerva herself must have taught her; but Arachne had grown vain as she grew dexterous, and, overhearing them, denied the implication with high disdain. She would not acknowledge herself inferior even to a goddess, and finally challenged Minerva to a trial of skill, saying: "If beaten, I will bear the penalty." Minerva accepted the challenge, and the webs were woven. Arachne's was of wondrous beauty, but when she saw that of Minerva she knew that she was defeated; and, in her despair, went and hanged herself. Minerva, moved by pity for her vain but skillful opponent, transformed her into a spider; and she and her descendants still retain a portion of her marvelous gifts of spinning and weaving.

Now, let us see how the garden spider uses its inherited talent. Each individual is endowed with a spinneret, or natural spinning machine, through which can be drawn innumerable strands, so fine that they can be seen only under a powerful microscope (Leeuwenhoeck claims that it takes four millions of these strands to make a thread as thick as a hair from a man's head).

First, our spider begins to draw from out her spinneret a cord of as many of these strands as seems to her good, and fastens it to some leaf or twig, then runs on another leaf, spinning all the while; fastens again to that; and to another and another; continuing until a circle is formed inclosing as large a space as she designs for the outer boundary of her web. Then she passes back and forth over her work, adding fresh threads, and strengthening this outer line, which she secures to every possible object. Finally she stops, fastens her thread with special care, and begins to run around the circle, spinning as she goes; but now carrying her fresh thread carefully raised upon one hind foot, thus keeping it from touching the older strands and becoming glued to them. When half way round she stops, pulls her thread tight, fastens it very strongly, and a firm line is drawn straight across the center of the circle.

She runs down this center line to the middle, fastens another thread to it there, carries it to a new point upon the outer edge, fastens it, and we now see that she is engaged in making those lines in the web that look so like the spokes of a wheel. She repeats this operation again and again, until all the radii or spokes are formed. When they are done she carefully tests each thread by pulling, to make sure that it is firm and strong; and, if one proves unsatisfactory, she either strengthens or remakes it altogether.

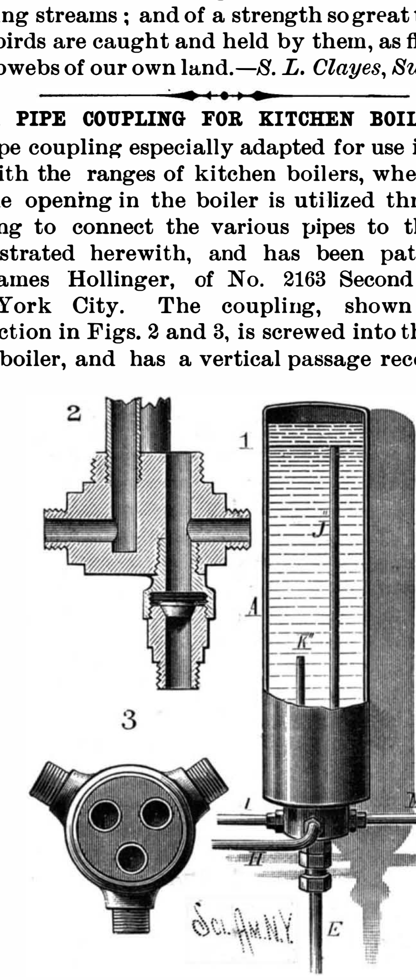
Now that the main lines are built, our spider goes once more to the center point, and begins to spin again —this time in circles—fastening to each radius as she passes. At first these circles, or more correctly spirals, are placed quite close together, but she leaves ever a wider and wider space between, as she approaches the outer edge. The outer circle and the radii were spun of a silk which becomes dry directly after leaving the spider's body, is of great strength, and very firm; but these spirals are formed of a substance which differs essentially. When first drawn from the spinneret it is extremely glutinous—a most important property, as by this it is enabled to adhere tenaciously to the radii—and it is, besides, so highly elastic as to be capable of being pulled far out of place without breaking.

When the spirals are finished, the spider returns again to the center, and proceeds to bite off the points of all the radii close to the first encircling line, by which she much increases the elasticity of her web. It is in or beneath this central opening that the spider usually sits and watches for the coming of her prey.

But while these circular creations are perhaps the most beautiful, they are by no means the only cobwebs. You have probably seen, or rather felt, the long gossamer threads that sometimes draw across the face, as one walks beneath the trees on a summer evening. At certain seasons they are very numerous. They float in the air; they fall upon the grass; they gather on the trees. These are all cobwebs. They are made by spiders, and in a manner so marvelous as to be almost incredible. The spider spins the silk from its spinneret, pushing it off into the air. It is so light that it does not fall; it rather rises in the air. It grows a longer and longer thread, until it is carried by some current against an object, often at a surprising distance, to which it attaches itself. This spider's slack rope is quite strong enough to serve the little spinner as a bridge, over which it can pass at its pleasure. Indeed, in the tropics, spider's webs are found of gigantic size, sometimes even spanning streams; and of a strength so great that humming birds are caught and held by them, as flies are by the cobwebs of our own land.—*S. L. Clayes, Swiss Cross.*

A PIPE COUPLING FOR KITCHEN BOILERS.

A pipe coupling especially adapted for use in connection with the ranges of kitchen boilers, whereby only a single opening in the boiler is utilized through the coupling to connect the various pipes to the boiler, is illustrated herewith, and has been patented by Mr. James Hollinger, of No. 2163 Second Avenue, New York City. The coupling, shown in plan and section in Figs. 2 and 3, is screwed into the bottom of the boiler, and has a vertical passage receiving the



HOLLINGER'S PIPE COUPLING FOR BOILERS.

screw-threaded end of the water supply pipe, E, in which is a valve to prevent back flow of water. From a side port leads the pipe, H, for conducting cold water to the range, I being the return pipe, communicating with a vertical passage, to which is secured the pipe, K, projecting a short distance up into the boiler, for directing the hot water upward. J represents a pipe reaching nearly to the top of the boiler and communicating through a horizontal outlet port with the pipe, M, leading to a sink or other place of use. By this arrangement the water drawn out is taken from the top of the boiler, where it is the hottest.

Mr. Edison on Patent Protection.

The unthinking and unintelligent members of the body politic who are clamoring for the overthrow of our patent law, under the wholly mistaken impression that the consummation of their design would, in some unexplained way, aid in the suppression of their pet bugaboo, "monopoly," have received a notable recruit to their ranks in the person of one of the principal beneficiaries of the system which it is proposed to destroy. Ordinarily, the right of a private person to the unmolested enjoyment of his own opinions in respect to this or any other subject is not to be questioned; but when an inventor occupying so prominent a position before the public as Mr. Edison appears on record as an exponent of the opinions attributed to him in the published interview which we reprint, his action ought not to pass without comment. Mr. Edison is reported as saying:

"The present law is a constant temptation to rascals, and virtually offers a premium upon rascality. Under it the infringer of a patent is not interfered with until the real owner can show that he has the monopoly of the device in question. This process may take years, during which the infringer who has money and audacity enough to seize another man's invention can go on and perhaps wear the rightful owner's life out by litigation and annoyance. I have had so much of this sort of thing within the last five years that I have almost made up my mind never to take out another patent until the law is changed. The burden of proof is now put entirely upon the man who holds the patent, instead of upon the man who wishes to infringe it, whereas it ought to be all the other way."

An old proverb bids one to speak well of the bridge that has carried him safely across the stream. It is not many years since Mr. Edison was earning, by diligence and industry, a modest stipend of three dollars per diem as a telegraph operator, and it is but just to say that he was accounted a very skillful one, and well worth the money. To-day he occupies the finest estate in the vicinity of the metropolis, and if he is not twice a millionaire, it can be for no other reason than that, like too many of the rest of us, he has found it less easy to keep money than it is to get it. We venture to assert that had it not been for the patent law which he now decries, Mr. Edison would, in all human probability, have been "pounding brass," as the phrase is, at this moment, although it is doubtful if, in the absence of the inventions which the patent law has fostered, anybody could afford to pay him more than $1.25 per day. Who would have given him a dollar in exchange for his quadruplex and automatic telegraphs, and his electric light inventions, had it not been for the patent law? Would he not have been obliged to content himself with the modest wage earned by daily industry? He adds, mysteriously:

"I have already found one chemical device which promises to pay me handsomely, and the Patent Office will never hear anything about it. To apply for a patent would simply invite a lot of rogues to share with me, or, what is more likely, to take all the profits."

Every right-minded person will be gratified to learn that the prospects of polyform, if indeed it be that excellent remedy which is referred to, are so flattering. But to return to the patent law. Mr. Edison complains:

"There is scarcely an invention of importance made within the last generation which has not been disputed upon frivolous grounds, and the inventor put to all sorts of annoyance. In my own case, I am sure that, no matter what I may patent, some one will come up as soon as the patent is seen to have any value, and show by dozens of witnesses, if necessary, that he is the rightful owner of the invention. If I patent to-morrow a process for making good flour at a cost of two cents a barrel, the publication of my patent would bring out about ten men who could prove that they did that sort of thing years ago, and that I had no right to a patent."

This is not simply an indictment of the patent law, but of all law whatsoever, and the real root of the trouble obviously lies, not in the statutes, but in that inborn proclivity of the unregenerate human animal which prompts him to appropriate his neighbor's property, and which it is one of the principal functions of the common law to prevent and punish. The patent law merely serves to protect the inventor by declaring that an invention is property, and that it may, therefore, be the subject of larceny.

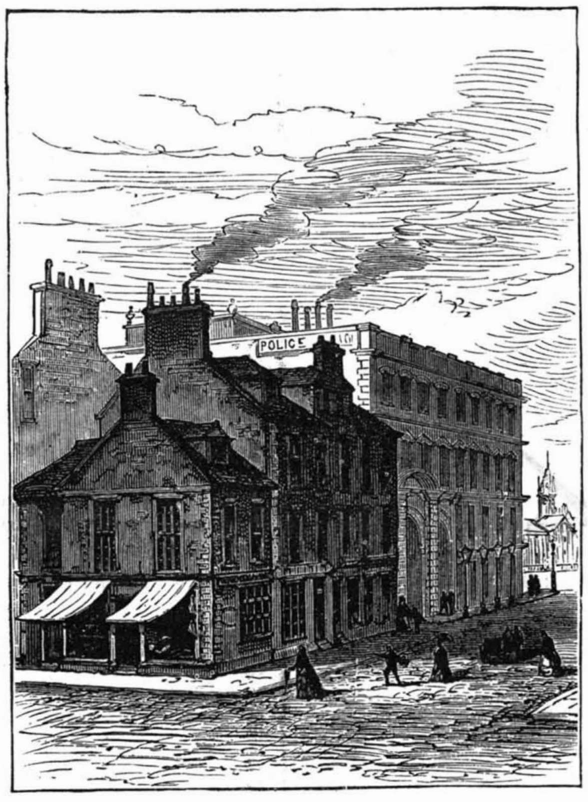
The federal courts have never, to our knowledge, pronounced any patent whatever invalid because of prior knowledge or prior use by another, except the anticipating invention had been actually embodied in a concrete and operative machine or method, and that fact had been proved beyond a reasonable doubt. That the law is designed to protect, and that it does in fact protect, the real originator is abundantly shown in the cases of such inventors as Goodyear, Howe, Morse, Bell, Edison, Westinghouse and many others, whose achievements have served to render the annals of American industry illustrious.

The fact is, and it is well to bear it in mind, that the pre-eminence of the United States, as distinctively a nation of inventors of improved machinery and processes, dates back no further than the patent law of 1836, which is substantially the one now in force, and it is to the fostering care of this wise statute, more than of any other which has ever been enacted by Congress, that this country owes its present prosperity and greatness.

Do not lay rash hands on the patent law. Let the American inventor be protected. *In hoc signo vinces.*—*Electrical Engineer.*

THE BIRTHPLACE OF JAMES WATT.

The inventor of the condensing low-pressure steam engine was certainly one of the greatest benefactors of mankind. James Watt was born at Greenock, on the Clyde, in 1736. The house in which he was born, No. 13 Dalrymple Street, in that town, has lately been pulled down by the Greenock Improvement Commissioners. We have to thank Mr. Cathcart W. Methven, engineer to the Greenock Harbor Trust, for a sketch of the street, showing the position of the house. It will be marked by a memorial tablet on the new building to be erected on this site. James Watt, in his youth, was apprenticed to a maker of mathematical instruments. He began, at the age of twenty, to make experiments with steam as a motive power. In 1770 he commenced practice as an engineer, and in 1774 entered into partnership with Mr. Matthew Boulton, of the Soho works at Birmingham, where his grand inventions were applied with speedy success and results of



THE BIRTHPLACE OF JAMES WATT.

amazing magnitude. James Watt retired from business in 1800, and died in 1819. He was the inventor also of the copying press, of improvements in the process of bleaching, and of many useful appliances in the manufacturing arts.—*Illustrated London News.*

Mechanical Progress.

The lecture which commemorates the birth of James Watt, in Greenock, on Jan. 19, 1736, was this year delivered in the Watt Institute, Greenock, by Mr. John Scott, C.B. In the course of it the lecturer said he proposed to direct attention to some of the records bearing on mechanical subjects which have come down to us in the cut stone work of the temples and the mural tablets in the tombs which still exist in Egypt, and supply the earliest definite records of the civilization and advancement of the wonderful people who inhabited that country more than 2,000 years before the Christian era. Much controversy has been raised among Egyptologists as to how the stone cutting of the temples, with the gigantic monolithic statues and incised hieroglyphic ensamples, had been performed.

We know the difficulty experienced by our most experienced granite cutters in getting tools of the best steel to stand, and as nothing in the shape of tools has been discovered, except in bronze, the solution of the problem must still remain an open one. It may be possible that they possessed some now unknown method of tempering the tool bronze. But this seems unlikely, as the analysis of most of the tools which have been tested shows that the alloy contained 88 per cent copper, 12 of tin, and some impurities not of any practical consequence. This is the exact alloy, if a small quantity of zinc were added, which is now used as the regulation mixture for all gun metal or bronze castings used by the Admiralty for Her Majesty's service.

Among the implements in use by the Egyptians, and frequently shown on the mural drawings, is the beam and scale with equal ended levers. The Italian or Roman balance is not found. The siphon was used by them for purifying muddy water, which was allowed to settle in one vessel placed at a higher level; and after the mud had subsided the water was drawn off from the top by putting one end of the siphon quietly into the vessel, whence it then flowed into another placed below it, in a pure state. The use of iron and steel does not appear to have been known in Egypt until after the exodus of the Israelites, but in the tomb of Rameses III., better known to us as Sesostris, 1235 B. C., iron forming a butcher's knife was discovered. So few traces of iron mines have been discovered in Egypt, it is difficult to believe that iron could have been a native product. It was probably introduced from India, where iron from native ores has been produced from very ancient times, and is still produced in small quantities. It is known as worked iron, and is the material used in the manufacture of Damascus blades and Indian cimeters.

Among the Greeks and Romans, in the periods which are covered by extant writings of authors of these nations, a vast advance in mechanical knowledge has to be signalized. Practical mechanics in those days had but two leading objects: warlike implements of offense and defense, both for sea and land, and machines for aiding in the construction of temples and public edifices and for temple worship. That such warlike instruments were then produced there is undoubted evidence, and that many of them held their own until within the last three hundred years is undoubted. But little evidence exists as to how their manufacture was carried out, except such as can be gleaned from the writers of a much later period. That the material used was principally timber, and that metals were but sparingly introduced, seems certain.

A Horse that Draws the Water He Drinks.

The sagacity exhibited by some of the horses employed by the fire department in this city is very remarkable, and their exploits have been frequently described in our daily newspapers. But for the first time we read in one of our evening contemporaries of a horse in the service of our ambulance corps, which is not far behind any fire engine horse we have read of in point of intelligence. The horse pulls the ambulance in search of patients for the New York Hospital, and during the whole period of his philanthropic career as an ambulance horse, he has never once been given a drink by any of the stable hands. He believes in the maxim that God helps those who help themselves, and helps himself accordingly.

A *Telegram* reporter went down to see how he quenched his thirst, and was edified by the intellectual behavior of the animal, which he describes as follows:

There is an ordinary faucet with a pail under it in the stable, and to this faucet the horse made a bee line.

First he dipped his nose in the pail to see if there was any water there, but finding there was none, he proceeded to open the valve by turning the handle with his nose. He did not turn it on quite enough at the first attempt, so he gave it another nudge, and held his nose under the spigot while the water poured over it to his apparent immense satisfaction. "But what a lot of water will be wasted when he leaves it running the moment he has had enough!" ejaculated the reporter.

"Wait and see," answered the driver.

And there was no water wasted, for the moment the horse had concluded his drink, he went at the faucet again with his nose and shut off the flow completely.

"Does he always do that?" again queried the newspaper man.

"Certainly," answered the driver, as he patted his four-footed friend on the shoulder. "As long as I've known him, that horse has never had a drink that he did not draw from the tap for himself just as you have seen him do this time."

Packing for Ice.

Sawdust to pack ice in is believed to be the best material, but this is very difficult to obtain in some parts of the country where there are no sawmills. A correspondent of the *Country Gentleman* comes to the rescue in such cases, and recommends, next to sawdust, oat straw cut short, if the oats have been thickly sown so as to make the straw small and soft, capable of packing well, without air crevices. If uncut, or cut rather long, it is liable to contain small crevices through which air may find its way, but if cut only a fourth of an inch in length, it may be placed nearly as compact as sawdust. Next to oat straw is fine soft hay. Wheat straw is too stiff, and will not pack solid, although by very short cutting it will answer if a greater amount is used. Good fine sawdust, well packed, need never be more than a foot in thickness, chopped oat straw will answer, well packed fifteen inches, but chopped rye or wheat straw should be twenty inches or two feet. Unchopped fine hay or oats will be quite as good as chopped wheat straw. Much will depend, however, on the care and skill with which the packing is applied, so as effectually to prevent the entrance of air through small crevices.

THE GUNS OF THE BENBOW.

Now that the Benbow is approaching completion in every respect, and about to be brought round from Chatham to Portsmouth for a trial of her great 111 ton guns, it is not an inappropriate time, remarks the *Engineer*, to say a few words in regard to the power and value of her armament, far surpassing—as it does—that of any ironclad afloat, whether in the navy of Great Britain or in that of any foreign power. The accompanying table will show in a moment that the 111 ton gun distances all competitors. In it a comparison is drawn between the salient features of our new weapon and those of the heaviest natures possessed by France and Italy—these being the only rivals worthy to be compared with it.

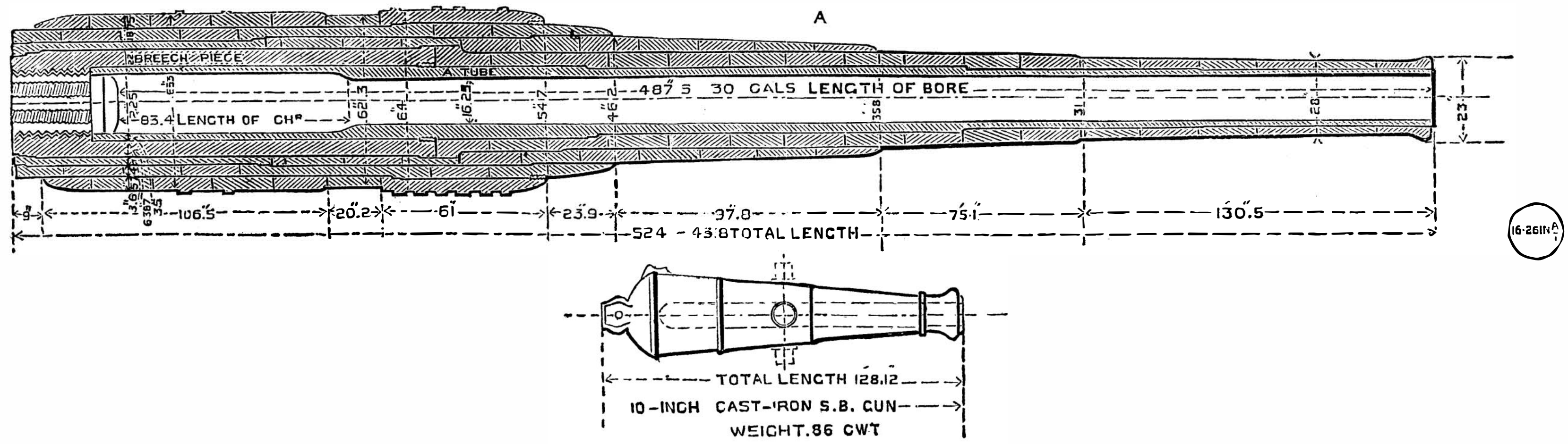
Country.	Caliber. In.	Weight. Tons.	Muzzle velocity. Foot secs.	Projectile. lbs.	Penetrative power.
Great Britain.	16·25	111	2,128	1,800	32·5 in. at 1,000 yds.
Italy..........	17	104	2,018	1,799	32·3 in. at muzzle.
France........	14·66	71	1,955	1,180	27·3 in. at muzzle.

Thus it will be observed that the Benbow gun has a greater penetrative power at 1,000 yards distance from the muzzle than the Italian gun—its most formidable competitor—has at the muzzle itself. This would appear to be conclusive.

Before giving a brief description of the construction and parts of the new gun—drawings of which we give —we cannot refrain from remarking upon the prodigious strides which have been made in the development of gunnery science since the period of our last great war, both as regards the dimensions of the weapons employed and the complex nature of the machinery by which they are loaded and fired. A glance at the sketches marked A herewith, which give the relative sizes of the modern 111 ton steel rifled B.L. gun and the old 10 in. cast iron S.B. gun of a past age—drawn to the same scale—will exhibit at once the extraordinary rapidity of that development as far as regards proportions. It must be borne in mind that at the close of the Crimean war, only thirty years ago, the 10 in. S.B. gun was the heaviest and most powerful piece of ordnance that Great Britain possessed, and we were then far ahead of all other nations in respect of armament. Yet in the present day the projectile and battering charge only of our most formidable weapon, taken collectively, actually bear an appreciable proportion to the entire bulk of the gun which was considered monstrous in 1857, computing to one-third of it in weight. The complicated nature of machinery required to load, fire, and control the new gun can be seen by a reference to the cut. It shows the gun mounted upon its proof sleigh at Woolwich Arsenal, and the powerful double derrick erected in rear of it, with traversing platform working beneath the davits for raising and supporting the projectile and charge—weighing respectively 1,800 lb. and 960 lb.—during the process of loading; also the duplex arrangement of Stanhope levers, carrier, and cam lever at the breech, form quite a bewildering maze of mechanical contrivances. The elevating, loading, and traversing will, of course, be performed by hydraulic power on board the Benbow, where the turrets are open and the breech of the gun is depressed beneath the steel deck for receiving its charge, but the mechanism of the breech-loading apparatus is as shown in the engraving.

The principal dimensions of the 111 ton gun are as follows: Total length, including breech gear, etc., about 45 ft.; extreme diameter, 65·5 in.; caliber, 16 25 in.; length of bore, 487·5 in., or about 30 calibers; diameter of powder chamber, 21·25 in.; capacity of same, 28·610 cubic inches; the charge is 960 lb. of what is called experimental slow powder, of hexagonal shape, with a hole through the center, and almost analogous in its character to the well known prismatic No. 1 brown, of which most of the charges for many breech-loading guns are now made up. The building up of these charges is most curious. It is like a child's puzzle map. A plan is drawn of the exact number of hexagons that will most nearly cover a space equal to the base of the charge. Rows and rows are then placed upon the first layer, always leaving the central holes clear above one another for the flash to communicate with the whole mass, as the sides fit exactly. The mass when made up fits into a stout silk bag, and after being "choked" is put into a long metal cylinder for conveyance on board ship. Five hundred and sixty of such cartridges form the "unit" for the Benbow in peace time.

A



COMPARATIVE SIZES OF 111-TON AND 10-INCH GUNS.

An initial velocity of 2,143 foot seconds was actually obtained on the 28th of March last at the proof butts, Woolwich Arsenal, with the second of the 111 ton guns. This was with 850 lb. of German powder only. It is not unreasonable, therefore, to assume that a higher velocity than that mentioned in our comparative statement might be regarded as normal. Of course this greatly increases the penetrative power of the projectile, and the *vis viva* or energy stored up in it. Making use of the generally accepted formula—

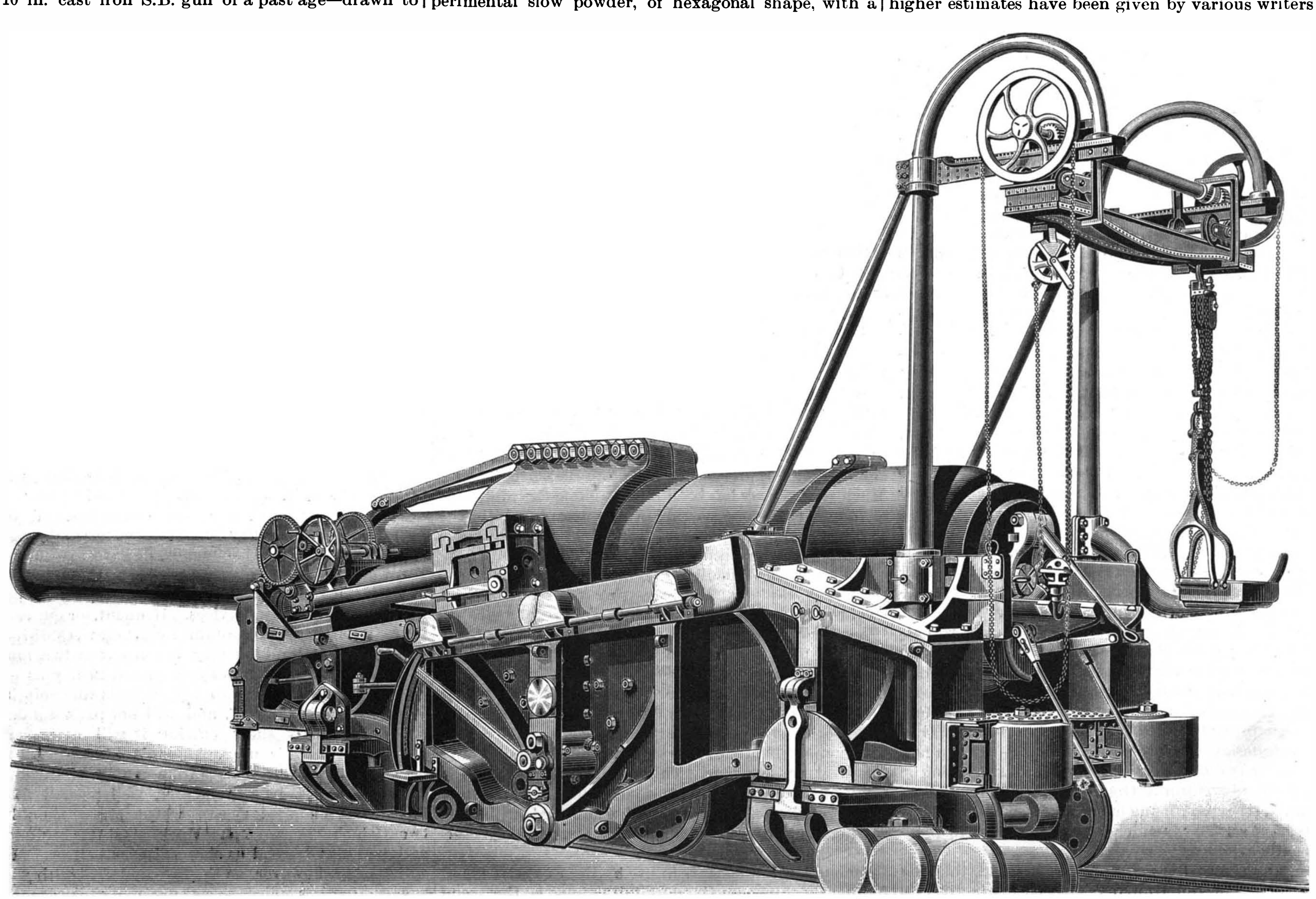
$$vis\ viva = \frac{w\ v^2}{2g}$$

where w = weight of the projectile in lb.

v = velocity in feet

g = force of gravity $(32 \cdot 2)^1{}_1$

we arrive at a muzzle energy with our newly constructed gun of no less that 57,304 foot tons, or nearly 5,000 foot tons in excess of anything before arrived at, the greatest amount of energy before recorded being that of the 100 ton Elswick gun of 17 in. It is true that higher estimates have been given by various writers of



111 TON GUN, H. M. S. BENBOW, ON ITS EXPERIMENTAL CARRIAGE.

the energy developed by this weapon, but it must be remembered that they were conjectural. Lord Brassey gives it in a table as 61,200 foot tons. As, however, in order to produce this abnormal energy he quotes a muzzle velocity of 2,214 foot seconds, which has *not* been obtained during the government trials at the Woolwich butts, the figures resulting from these velocities are misleading and untrustworthy. Be it as it may, however, the 111 ton gun stands unrivaled among its compeers, and the Benbow, Sans Pareil, and Victoria will have by far the most powerful armament afloat in all the navies of the world. We only regret one circumstance connected with the mounting of these guns. It is that they should be so entirely exposed above the open turrets. This, however, is a defect of the Admiral construction which cannot, we fear, be remedied.

LEWIS MUHLENBERG HAUPT.

BY C. H. H.

Could the spirit of progress have taken its place a hundred years ago in the neighborhood of the morning star, and watched the American continent as it slowly turned toward the dawn, it would have seen a country wearing still the undisturbed livery of nature, and unsubdued by the thought of man. In that grand kaleidoscope, prairie and forest, mountain and valley, succeeded each other in endless variety, and when the gilded crests of the Coast Range and Sierra Nevada finally sank out of sight beneath the horizon of the Pacific, the vast ocean that stretched into the distance bore no fleet upon its bosom. The darkness of succeeding night was lessened only by the radiance of occasional village lamps or savage camp fires.

But to-day could that same spirit, with Mercury for company, follow the advancing light from ocean to ocean, the same broad plains and lofty mountains, the same swift rivers and fertile valleys, would meet the eye as before, yet everywhere would be seen the dominance of man, the master. The plains are yielding harvests, the mountains, stores of gold and iron ; the torrents have been bridged and the valleys converted into homes. Swift steamers cross its waters, and loaded trains its lands. On all sides would be seen the wonderful results of human activity. No magician has been at work, though even the conjurer's art could scarcely have been more potent. Back of each of these changes there has been an idea, and back of the idea a man. The modern magician, at whose touch distance is annihilated and busy cities spring into being, is the engineer. It is his collective work that has changed the face of nature.

It is said that the best history is biography. In science and engineering as well, the best record of ideas is to be found in the lives of the men who held them. In presenting, then, a brief sketch of one of the busiest of these workers, there is given a fragment of the history of progress.

Professor Lewis M. Haupt, whose activity as an engineer perhaps entitles him to be called the successor of Captain Eads, is a native of Pennsylvania. He was born at Gettysburg, on March 21, 1844. His father, General H. Haupt, was at that time professor of mathematics at Pennsylvania College, but shortly afterward becoming connected with the Pennsylvania Railroad, he removed his family to Harrisburg, and subsequently to Philadelphia. Professor Haupt's boyhood was spent in an engineering atmosphere. He attended the public schools for a short time, but his health being delicate, out-of-door exercise was recommended in place of the school room.

As General Haupt now assumed the contract for building the Troy and Greenfield Railroad, and the Hoosac Tunnel, the son had an excellent opportunity to put this recommendation into practice. He was but fourteen years of age when his engineering work began. School, however, was not entirely given up. The winters were spent at the Greenfield and Cambridge High Schools, and later at the Lawrence Scientific School. From the latter institution he was appointed by President Lincoln, in the fall of 1863, to a cadetship at West Point. Four years later Professor Haupt was graduated and immediately assigned to duty in the United States corps of engineers. His first work in the service was with a party then conducting the triangulation of Lake Superior.

It is generally considered somewhat of a disadvantage that Americans move around so much, but it has the compensation of affording a wide experience. Though the severe climate of the lake region made it very soon necessary for Professor Haupt to apply for a change of duty, the experience gained there was of great value to the engineer and future teacher. In the spring of 1869, the young lieutenant was ordered to report to General Canby, then in charge of the Fifth Military District (Texas). The change from one frontier to another brought a corresponding change of duties. As aid and engineer officer, his work consisted chiefly in the examination of government buildings and military roads. He had also occasion to devise a scheme for the protection of the Fort Brown Reservation from the encroachments of the Rio Grande.

Again Professor Haupt's work was of short duration. In the fall he resigned from the public service in order to accept the position of assistant engineer and topographer in charge of the surveys of Fairmount Park, in Philadelphia. He was engaged on this work for several years, collating the data for an elaborate contour map, and locating and constructing the drives, drains, and other engineering features of this extended pleasure ground.

In 1872 came another change of occupation. He was appointed an assistant examiner in the Patent Office in the class of engineering and architecture. Though enjoying rapid promotion, he resigned his position in a few months in order to accept the professorship of civil engineering at the University of Pennsylvania. Up to this time Professor Haupt's life had been spent in gaining experience. He was now in a position where he could make good use of it, both as a student himself and as an instructor. It is at the university that his best work has been done. A professorship offers unusual opportunities to a man of ideas. The work of the position is itself constantly stimulating, while the leisure it affords permits him to undertake researches that would be quite impossible to a busy man of affairs.

The danger of it is possibly that one may be tempted to let this outside work encroach too far upon the time that should be devoted to his students. On the other hand, if kept within proper bounds it adds greatly to the efficiency of the teacher, for it gives him a constantly increasing store of experience to draw upon. In this respect, Professor Haupt has been fortunate in the utilization of his spare time. He has spent the long vacations of summer in practical engineering work. He has held appointments as an engineer in charge of the light house service in making hydrographic surveys for the range lights in the Delaware, as an assistant in the United States Coast and Geodetic Survey, in charge of the geodesy of Pennsylvania, for five years, and of various works on the Northern Pacific Railroad.

In 1877 the Engineers' Club of Philadelphia was organized, and Professor Haupt chosen as its first president. It is now one of the largest and most influential technical organizations in the country. The proceedings of the club contain many of his contributions, the papers on Intercommunication in Cities, Rapid Transit, Harbor Studies, and Proposed Removal of Smith's Island (in the Delaware River opposite Philadelphia), being perhaps among the most important. The titles to Professor Haupt's numerous articles and monographs, for his pen has been a very active one, show a wide range of subjects, but it will be observed that prominence has been given to those problems of engineering which come the nearest to everyday life.

However busy a man may be, and however varied may be his occupations, first preferences are pretty sure to come to the surface if they have half a chance to do so. In Professor Haupt's case, his first professional work was in the triangulation of Lake Superior, and throughout the rest of his career his attention is constantly reverting to the problems connected with water and waterways. At the present time his name is prominently before the public, on account of the valuable contributions of a practical character which he has made to our knowledge of the conditions essential to all harbor improvements. In his most recent paper on the subject, "The Physical Phenomena of Harbor Entrances," he has presented important discoveries and suggested new methods for a general solution of the difficult problem of improving the entrances to all alluvial harbors. In recognition of the merit of these discoveries, the American Philosophical Society has just awarded him the Magellan premium, the highest acknowledgment it is in their power to confer. The jealous care with which the honor is guarded by that conservative body may be judged from the fact that the award has been granted but twice during the past forty-five years.

Like most valuable discoveries, Professor Haupt's is so simple that the only wonder is that the engineers who have been spending such large amounts on attempted harbor improvements had not long ago found it out for themselves. He has shown that bars are the result of the increasing semi-diurnal action of the flood tide as it is affected by the general trend of the coast line and compressed toward the bight of the three large bays extending along the Atlantic coast from Cape Sable to Cape Florida. The mean tide at the salient points of these capes is between one and one and two feet. It gradually increases along their flanks to its maximum value at the greatest distance from the chord joining the points. The ebb channels and the crossings over the bar are moulded by this component. To prevent in part the compression and deflection of the ebb channels, Professor Haupt has proposed a barrier of peculiar form, which is designed to prevent the land from being carried into the channel by the flood. It is so constructed, however, as to freely admit the flood tide to the inner bay, and concentrates the ebb. The length of the proposed barrier is ultimately to be about one-half that of the present jetty system. The latter, it is contended, does not fulfill the conflicting conditions of this admittedly difficult problem. The method seems to be very simple and efficient, and if carried into effect might reasonably be expected to accomplish much for our alluvial harbors.

Professor Haupt is the author of several standard works on engineering subjects. He is also actively connected with a number of prominent societies besides the Engineers' Club. When the scheme for reorganizing the public civil works was under discussion in 1885, he was one of the delegates and was assigned important duties. The result of his investigations was published in *Lippincott's Magazine.* His system of movable dams for use in tidal waters is familiar to most of the profession.

As a teacher, Professor Haupt can best be judged by his results. He has been a very busy man outside of the university, but his work there has gained rather than suffered by this activity. It has brought the student into actual contact with the problems of the times. It has undoubtedly been a great help to them, and has given them a working efficiency unattainable by more abstract methods of instruction. The department of civil engineering ranks among the first in an institution which enjoys the distinction of numbering among its faculty some of the most eminent men in America.

The Elements not Patentable.

In arguing the Bell telephone case before the Commissioner of Patents the other day, Robert G. Ingersoll, one of the counsel, closed his argument with the following pertinent remarks, which it will be well for all inventors to remember. The conclusions are sound and as applicable in other cases as the one on which the learned counsel made the application:

"I do not believe any man can patent the idea of sending speech by electricity. He can patent devices by which that can be done, but he cannot get a patent on the lightning. A man can patent a water wheel but he cannot patent the water, or say to the water you cannot turn any other wheel but mine. A man can patent a windmill, but not the wind, and any man who can make a better mill may use the same wind, because we do not get our entire stock of wind from the Patent Office or from the attorneys on the other side. Wind is the free gift of all politicians, and, looking at the attorneys of the Bell people, without wind where would your case be?"

IT is said that a finely polished lusterless surface can be produced in steel by rubbing, after tempering on a smooth iron surface with some ground oilstone till it is perfectly smooth and even, after which it should be laid on a sheet of paper, and rubbed backward and forward till it acquires a fine dead polish.

UMBROMANIA.

The idea of projecting the shadows of different objects (among others, the hands) upon a plane surface is very ancient, and it would be temerary to attempt to assign a date to the creation of these animals and classic figures, such as the rabbit, swan, negro, etc., that have served to amuse children in the evening since time immemorial.

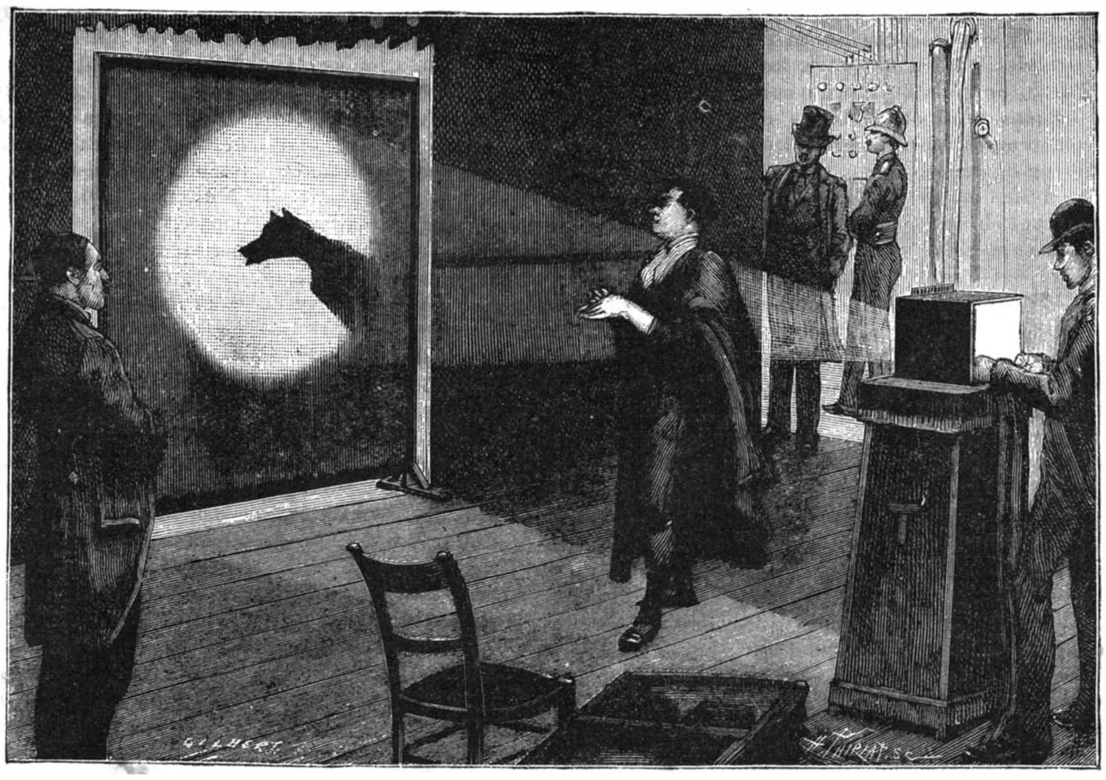


Fig. 4.—TREWEY EXHIBITING UPON A STAGE.

Within a few years, these rude figures have been improved, and we are going to show how the play of shadows has now become a true art instead of a simple diversion. The Italian painter Campi was one of the first who thought of adding new types to the collection of figures capable of being made with the shadow of the hands. He devised amusing forms of animals that delighted the school children before whom he loved to exhibit them. His imitator, Frizze, imported the nascent art into Belgium, and it was in this latter country that our countryman, Trewey, got his knowledge of it.

Trewey was not long in discovering that umbromania was capable of improvement, and, after patient exercise of his fingers to render them supple, he succeeded in producing new silhouettes, which are, each in its kind, little masterpieces. Before giving a glimpse of these, we must point out what the various exercises of the hands and fingers are that it is indispensable to perform in order to reproduce such figures more or less perfectly.

The first exercise consists in bending the little finger as much as possible without moving the others, while the hand is spread out. It must be understood that all that is done with the right hand must be repeated with the left.

The two hands being once broken in to this motion, the little finger is raised and an effort is made to bend the middle and ring fingers, while the fore and little fingers remain extended.

Fig. 1.—SHADOWS OF A DOG SWALLOWING A PIECE OF MEAT.

The third exercise consists in bending solely the two last joints of the fore and little fingers, while the ring and middle fingers are bent inwardly. In this position, if the thumb be bent inwardly, it will be found that the shadow made by this profile on the wall will form the head of a cat.

The fourth exercise consists in leaving the two last joints of the first and little fingers bent, and in extending the middle and ring fingers. Afterward follow exercises in separating the fingers from each other by opening them in the direction of the width of the hand. First, it is the little finger that is isolated, the fore, ring, and middle fingers resting against each other; then it is the separation of the fingers into two groups, the little finger against the ring finger, and the middle against the fore finger, the latter and the ring finger making as wide an angle as possible. Then comes the assembling of the fingers, the extremities of each being hidden behind the middle finger, so that the hand has the profile of a spear head.

Finally, we have the exercises in which each finger is made independent of the others, one being bent to the first, the other to the third joint, the latter extended as when the hand is open, the former elongated and at right angles with the hand.

It is through such a series of exercises of the fingers that Trewey has made his hands so supple that he not only can form the most diverse figures upon a screen, but can also give them motion and life. The swan smoothing its plumage, the bird taking flight, the cat making its toilet, the tight rope dancer, who, after saluting the public, rubs chalk on her feet before walking on to the rope, are true wonders, and it is hard to believe that these perfectly accurate profiles are obtained solely by means of the shadow of the hands. The artist has thus far devised more than 300 figures, and his inventive mind is leading him to get up new ones every day.

Instead of reproducing a large number of these, we have thought it would be better to devote ourselves to the study of one in particular, in order to initiate our readers the more perfectly into the art of umbromania. Let us, for example, take the dog's head represented in Fig. 1 (No. 1). The ears are erect, the snout is thrust forward, and we conjecture that the animal has just scented a choice bit. In fact, he is snapping at it, and No. 2 shows us the efforts that he is making to swallow his prey, which is represented by the angle of the bent forefinger that moves in the mouth. After strong efforts, the mouth is seen to close (No. 3), showing the act of swallowing. A progressive motion of the hand shows us the swelling of the throat caused by the descent of the food in the œsophagus. One would imagine that he had before him the shadow of a genuine dog, so wonderful, natural, and accurate are the motions. After this laborious repast, we finally see the animal yawning voluptuously, the middle finger representing the tongue, which cleaves to the palate, and the general profile of the head expressing the completest beatitude.

It is very evident that in order to reach such a degree of perfection, the artist must be naturally endowed with great manual dexterity, without which the preparatory exercises would give no result. There are signs by which such dexterity is recognized, and an attentive examination of Trewey's hand has enabled us to verify the laws laid down by Mr. H. Etienne upon the native perfection of the senses. Thirty-five years of research have permitted Mr. Etienne, who has been continuously in contact, in shops, with Swiss watch makers' apprentices, experienced workmen, and artists even, to find a certain criterion by which to judge of aptitudes in different trades and several professions.

A young Frenchman who, after reverses of fortune, was

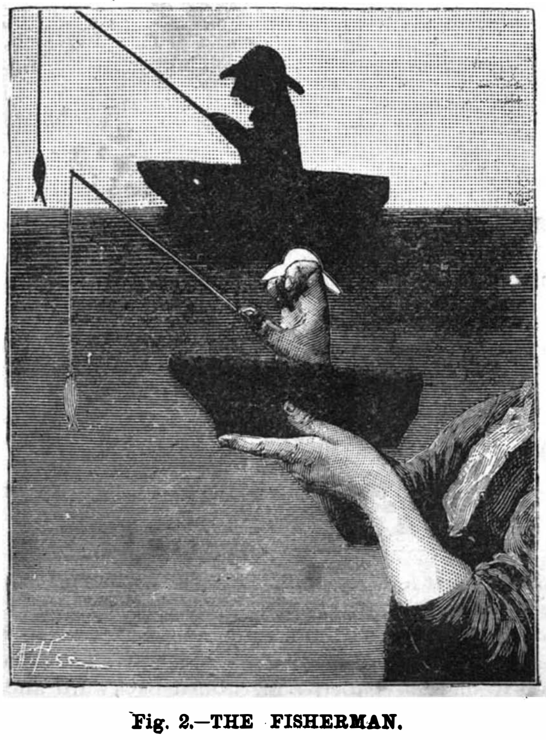


Fig. 2.—THE FISHERMAN.

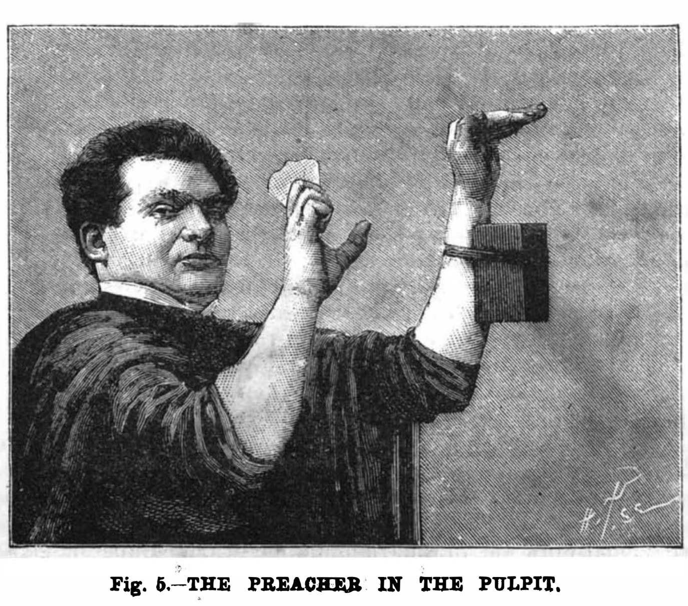


Fig. 5.—THE PREACHER IN THE PULPIT.

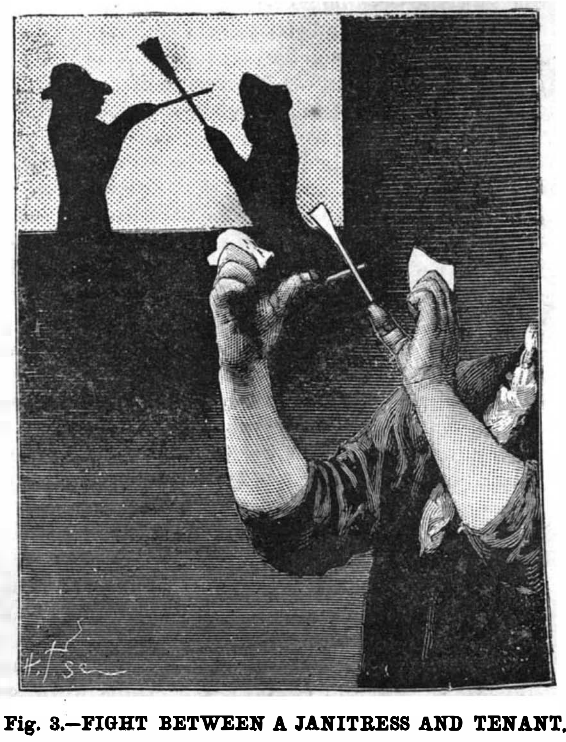


Fig. 3.—FIGHT BETWEEN A JANITRESS AND TENANT.

desirous of giving up the study of the law in order to learn watch making, presenting himself one day before Mr. Etienne at the shop of a skillful master of apprenticeship, who received the intelligent countenance with eagerness; but, while pressing the hand of the future apprentice, a cloud passed over the face of the placid master clock maker. "What did you feel, then, in pressing the hand of that young man who has just gone out?" asked Mr. Etienne. "With hands like his we don't make a watch maker," was the reply, and the prediction came true. It was as a consequence of this conversation that Mr. Etienne sought and discovered the following rules, that we think we can reproduce without straying from our subject.

The characteristic of dexterity is shown in the first place by the *curve of the thumb arched outwardly*. This is an indispensable condition for the handling of the hammer. The blacksmith, who wields with his arm the heavy striking mass that he lets fall perpendicularly, without deviation, repeatedly upon the same point; the file cutter, who strikes so regular blows upon the chisel that no flaw is visible in the cut, so equal everywhere is the imprint of the tool—these and all superb workmen, all artists who shape white hot iron with the hammer, who chisel the precious metals, who sculpture marble and stone, owe the exact precision in the force and accuracy of the blows that they give with the hammer to the suppleness of the first joint of their thumb. To this natural gift they owe their fortune, for, in shops, selection is made, to the profit of the most skillful, of those alone to whom the most difficult and most delicate work can be intrusted.

A second characteristic of skillfulness is indicated by the faculty of reversing the metacarpal phalanges of the fingers, so that when the hand is extended it is convex. On the greater or less flexibility of all the joints, either at the base or extremity of the fingers, depends the dexterity and skillfulness displayed in work executed with the file, plane, or lathe.

This suppleness cannot be independent of that of the thumb, but it does not replace it; while the curved thumb will more easily dispense with the great flexibility of the other fingers. These two characteristics are in most cases united.

Trewey's hand, reproduced by moulding, figures in several English museums. It possesses the faculty of reversal of the phalanges to the highest degree, and the thumb, which is of wonderful suppleness, renders Trewey, as we shall see, the greatest services in the formation of his shadows. Let us add that his fingers, which are long and slender, differ very perceptibly in length, the middle finger, for example, exceeding the ring finger by nearly an inch.

In addition to the profiles of men and animals composed by the artist, the latter, by means of a few accessories, exhibits to us living persons playing amusing pantomimes. Here, for example (Fig. 2), we have a fisherman. A piece of cardboard, properly shaped and held between two fingers, forms the hat; the boat is a piece of wood held in one of the artist's hands; a metallic ring holds the fish pole against the thumb of the other hand, and it is opposite this latter, bent as shown in the figure, that we observe all the emotions of the fortunate fisherman, who, phlegmatic at first, and livening up when the fish bites, finally is triumphant when he has it at the end of his line. It is necessary to have witnessed all these little scenes in order to understand how, by means of his fingers alone, the artist can evoke the laughter and applause of hundreds of spectators. Here, now (Fig. 3), we have a scene with two persons. It is a fight between a janitress and one of her tenants. As may be seen, the accessories are here very simple again. We believe that with a little practice our readers might succeed in reproducing these little scenes, and even get up new ones.

To make the shadows sharp, the following things are indispensable: The source of light must be a single lamp inclosed in a projecting apparatus, throwing very divergent rays. The lens must consequently be of very short focus. The electric light or oxyhydrogen lamp necessary in a theater may be replaced at the amateur's house by a lamp, or, better, by a wax candle, or, indeed, even by a common candle that gives very sharp shadows. The mirrors in the room where the exhibition is given must be veiled in order to prevent reflections, and all brilliant objects must be removed. When the oxyhydrogen lamp is used, the screen is placed ten feet away from the light, and the artist's hands at three feet from the same, and consequently at seven from the screen. But it will be understood that there can be no absolute rule about this, all depending upon the scale of the figures. It suffices to recall the fact that the nearer the hand is brought to the light, the more the shadow enlarges and loses its intensity, while on bringing the hand nearer the screen the shadow becomes sharper, but smaller and smaller. Fig. 5 shows Trewey exhibiting the scene of the preacher in the pulpit. The canopy is formed by the arm and the first phalanges of the fingers, bent at right angles, while a block of wood affixed to the arm near the wrist forms the pulpit. In order that the preacher may appear smaller than the pulpit, he must necessarily be nearer the screen, and this explains the distance apart of the artist's arms in our engraving, the screen being situated in front of the arm that forms the preacher. The necessary distances, however, are best determined by experiment.—*La Nature.*

Driving the Jack Rabbits.

The Bakersfield people celebrated new year's Monday with their initial round-up of the rabbits at Henry Borgwardt's ranch, four miles from town, westward. There was a circular corral at the corner of his alfalfa field, where the sagebrush and pasture lie side by side. From this inclosure two wings of lath fence were stretched at right angles for a few hundred yards.

By 2 o'clock in the afternoon a large number of people had gathered, some on horseback, others in light vehicles. They had a commanding officer and a few field managers. No dogs were allowed upon the ground, and but a few guns in the hands of experienced sportsmen. The crowd having been so distributed and marshaled as to form a curving line about a mile in length, a signal to move forward was given and the drive toward the corral commenced. The area inclosed by the drivers must have been less than a square mile, but the *Echo* says that "as they drew near the apex of the triangle it seemed as if there were acres of rabbits. Of course a great many ran back past the people, and several hundred were killed with sticks while doing so, their fright being so great that they would run within a few feet of one's conveyance. When the corral gate was shut, it was found that the drive had been a grand success. By actual count after they were killed, there were 1,126 rabbits in the pen. Another march was ordered, and by passing over the same territory 796 rabbits were corraled and killed, besides a large number that fell by the way. It was generally believed that 2,500 was a safe estimate of the total number killed in the two drives."

Of course no firearms whatever can be used inside the corral, only clubs are permissible. Another observer writes: "It looked like very cruel sport, but their destruction is an inexorable necessity. Relentless war must be waged against them or they will take entire possession of the country."

This method of dealing with the destructive rodents bids fair to become quite general where they abound and the lay of the land favors; and as our "rabbits" are all hares, which know not the trick of escaping into burrows, the results of the process are comparatively certain.

At Bakersfield, Kern County, on January 10, there was a great rabbit drive. The account of the affair given in the *Echo* of January 12 is so sprightly, and contains so many valuable practical hints as to how a drive must be managed in order to secure the greatest success, that we quote it bodily:

In accordance with posters generally circulated about Bakersfield, a second rabbit drive took place at H. L. Borgwardt's ranch, the same place as the former one. At 1:30, the hour set for the meeting, at least 500 people had assembled on the grounds, and after partaking of the generous lunch prepared by Messrs. Swain and Borgwardt, proceeded to the place where the drive was to be held.

Preceding this, Commander McCord had sent a large delegation of horsemen to "round up" the rabbits in the field west of that where the principal work was to be done, so that by the time the crowd was ready to move in a body to the place where the drive was to commence, hundreds of rabbits had been driven out before them.

Companies were rapidly organized, 20 men on foot being assigned to each captain who was mounted. Eleven companies of men and boys were given positions, and two of ladies and girls under command of lady captains; and it is claimed by those present that more enthusiastic hard work was done by the latter than by any one else. Two large companies of men and boys on horseback, commanded by competent captains, were placed at the extreme right and left wings. The whole command formed a semicircle.

When all were in position, the commander raised his handkerchief, the signal for the start; this was repeated by his assistants and the captains, and simultaneously the whole line began a quiet work toward the corrals. At first the rabbits trotted slowly ahead of the drivers, but soon the horsemen on the left wing opened up a general shout, contrary to the programme, which so excited the rabbits that they turned toward the right wing, and ever so hard work of those in charge of that wing could not keep half of them from passing the line.

As the circle gradually closed, the drivers made a more compact body, so that when they reached the rabbit-tight wings there was little chance for a rabbit to go back without encountering one of the clubs in the hands of the footmen. Hundreds of them were killed in this way.

Just before the gate to the corral was reached, there was a general disposition on the part of the rabbits to turn toward the crowd. Had the latter been held in check for a minute, so as to give the rabbits an opportunity to see the gate, every rabbit would have been captured, but there was no such delay, and the result was that nearly half of them went through the crowd.

It was estimated that 2,000 were corraled this drive. They were speedily killed with clubs and a second drive ordered. Commander McCord sent a large force of horsemen into the field north of the one where the main drive was held, to drive the rabbits in front of the companies, and it proved to be an excellent move, as it increased the count in the next drive by at least 1,000. Aside from the shouting by those on horseback, the last drive was as near a success as any one could wish. At the close, when fully 3,000 rabbits were massed in front of the gate, undecided which way to turn, the commander and his assistants held the crowd in check until the rabbits started for the gate, when a general rush was made, and in an instant 3,000 more rabbits were in the corral. After the killing a count was ordered, and the number was 5,075 in the corrals, and it was estimated that at least 500 were killed on the outside. This would total over 8,000 rabbits killed inside of one week on a field of less than 300 acres.

Photographing Invisible Objects.

New means for the photographic study of the stars has recently been devised by Mr. C. Zenger, which may probably find other applications in science. Mr. Zenger, struck by the phenomenon that the summit of Mont Blanc retained after sunset until half-past ten a phosphorescent bluish appearance, thought it possible to utilize it for obtaining a photograph of the mountain. For this purpose he projected, by means of a photographic camera, the image on a plate covered with a layer of Balmain's luminous paint. After an exposure of a few seconds, this plate was held in contact in the dark with a dry photographic plate, and at the end of an hour the image of the mountain was obtained complete with all details, as if taken in the ordinary way. This result permitted conclusions to be drawn that the carbonate of lime exposed during the day to a brilliant sunshine emitted during the night invisible but very actinic rays. Experiments were made at Prague, where very fair photographs of the buildings surrounding the observatory were obtained during night time, which seems to confirm the theory that light can be absorbed and slowly re-emitted, and that the images of invisible objects can be fixed in the darkness by means of actinic rays. This new process will no doubt be of service in the preparation of astronomical maps, but can be applied to other things. Ordinary paper also possesses the property of returning light, and when impregnated with fluorescent solution, such as nitrate of uranium, latent pictures can be obtained, which can be developed months afterward, if they have been preserved in the dark in perfectly dry air. Mr. Zenger has studied this subject for more than two years, and has succeeded in preparing plates sensitive to all the radiation of the solar spectrum, from ultra violet to ultra red. He thinks there can be little doubt that, by rendering the invisible rays visible through their photographic effects, many fresh revelations about the constitution of the universe and its component natural objects may be obtained.—*Iron.*

Stones in Seals' Stomachs.

At a recent meeting of the Bristol Naturalists' Society, Dr. A. J. Harrison read a paper on "The Ballast Bag of the Seal." The seals are carnivorous mammals divided into two classes—the Phocæ, or common seals with rudimentary ears, and the Otariæ (sea lions, bears, elephants), which have the ears developed. According to the fishermen, the Otariæ have an internal pouch known as the "ballast bag," because it is always found to contain a number of rounded stones. The presence of these is accounted for by saying that when the animals grow very fat they become so buoyant as to be unable to sink below the surface of the water without the aid of some ballast, which they secure by swallowing stones. This theory implies the possession by the seals of considerable reasoning power. Observations have shown that the so-called "ballast bag" is only the stomach; and accordingly some people have suggested that the stones are intended to assist in the trituration of food, in somewhat the same manner as in the gizzard of fowls. Other persons suppose the stones subserve no useful purpose, and are accidentally introduced with the food, or in play. In the seals and sea lions at the London Zoo similar rounded stones have been found, large numbers of which are quite foreign to the geological character of the district. A Newfoundland seal which died at the Clifton Zoo in 1886 was examined by Dr. Harrison, who found in the stomach gravel, nuts, and pieces of stick.

Cable Roads in England.

According to our English exchange papers, the cable system for tramways has just been introduced at Birmingham. They speak of it as marking another important departure in the mode of street travel, and prophesy its wide introduction in other cities. A cable road is now being constructed between Kensington and King William Street, old London.

ENGINEERING INVENTIONS.

A car coupling has been patented by Mr. Edward A. Olmstead, of Buffalo, N. Y. The main objects of this invention are to relieve the car body timbers of buffing or pulling strain, and to so mount the drawbar that no actual strain will fall upon the king pin or bolt, the invention covering various novel details of construction and combinations of parts.

A frogless switch has been patented by Mr. Frank Nemacheck, of Appleton, Wis. Combined with the main line rails, an intermediate rail section and siding rail section, is an auxiliary rail connecting with either of the intermediate rail sections, an operating lever connected to a rod, and S-shaped crank connections, to dispense with the use of the ordinary form of frog.

A car coupling has been patented by Mr. Carlos J. Warren, of Jamestown, Dakota Ter. A spring-actuated bumper bar is held to slide at one side of the drawhead, a dog being pivoted upon the bar and a lift bar pivoted below the bar, with a crank arm adapted to engage the dog, with other novel features, making a coupling which can be operated without passing or standing between the cars.

MISCELLANEOUS INVENTIONS.

A combination tool has been patented by Mr. Joseph Brouse, of New Berlin, Pa. It consists of a hammer, saw, square, nail puller, and plane, all mounted on a single handle, in a novel way.

A saw file adjusting weight has been patented by Mr. William Moore, of Mooney, Ind. The invention consists in combining with a file handle a pendent weight by which the file may always be held at the same angle, thus insuring uniformity in the angles of the teeth.

A machine for winding bobbins for sewing machines has been patented by Mr. George H. Willey, of Abington, Mass. This invention covers a novel construction and combination of parts, making a machine which is simple, and easily and quickly operated for winding one bobbin at a time.

A snapper attachment for whips has been patented by Mr. William Becker, of Brooklyn, N. Y. It is designed to form a rigid and durable connection with the whip tip, and consists of a stiffening piece of tubular section of a quill, embracing the tip, a plaited covering extending over the whip tip and strengthening piece, and forming a loop.

A mechanical movement has been patented by Mr. Abraham L. Akins, of Larimer's Station, Pa. The invention covers a novel construction and combination of parts, so arranged as to be operable by hand or foot, and applicable for use in the transmission of power to almost any form of light machinery.

A measuring faucet has been patented by Mr. Ole Martinson, of Meridian, Wis. The invention covers novel combinations and constructions of parts for use in relation to a suitable supply, whereby accurate measuring is accomplished without waste, or the entrance of dirt or insects to the liquid or commodity being measured.

A coffee pot has been patented by Mr. Harry B. Cornish, of Blue Earth City, Minn. It is of that class having an inner vessel to hold the ground coffee, into which boiling water is poured and allowed to percolate through the coffee and a strainer into the main outer vessel, the invention covering novel details of construction and combinations of parts.

A rounding jack for hat brims has been patented by Mr. Michael Hild, of Philadelphia, Pa. This invention relates to a former patented invention of the same inventor, and covers a sectional rod for operating the knife stock, whereby, when the stock is drawn back nearly to the end of the jack, the rod may be contracted so as not to be in the way when using the jack.

A surgical splint has been patented by Miss Annie Caller, of Albany, N. Y. It has extensible side rails, a plate connected thereto forming rests for both legs of the patient, straps for securing the patient, and other novel features, making a simple and inexpensive apparatus, which may be quickly and easily applied.

A ticket holder has been patented by Mr. Moses H. Straus, of Columbus, Ohio. It consists preferably of a single piece of wire bent upon itself in novel form, making a device capable of ready and easy attachment to a bolt or piece of goods to retain a label, and also for attaching a ticket to articles of apparel or goods.

A wagon seat has been patented by Mr. Charles Van Horn, of Bethlehem, Pa. Springs are secured to the longitudinal center of the seat, in combination with pivoted boards provided at the center with arms linked together and to the springs, in combination with supporting irons, so that the seat will have only a level up and down motion.

A lock for firearms has been patented by Mr. Jacob Nicely, of Enon Valley, Pa. It is a combination of two locks, the sears of which have lugs projecting inwardly and arranged in different planes, a trigger being centrally located in the stock between the locks, whereby provision is made for releasing either of the hammers or both in rapid succession.

A device for weighing and sacking grain has been patented by Mr. Charles E. Cole, of Somerville, N. J. The invention covers a novel construction and combination of parts, affording means whereby the grain is automatically weighed and sacked on passing from the thrashing machine, the grain being delivered continuously without interfering with the weighing.

An indicator for non-transparent receptacles containing liquids has been patented by Mr. Frank H. Palmer, of Long Island City, N. Y. Combined with a reservoir is a tube secured to the top and extending inwardly, a transparent cover being secured to the top of the tube, and a float adapted to slide freely in the tube, the float being seen only when the receptacle is nearly full.

A washing machine has been patented by Mr. Marvin Newton, of Girard, Pa. A rocking rack or open bottom is journaled in a tub, a rocking presser being journaled above the rocking bottom and made hollow at the under side, and having air holes and valves closing them, to induce suction, whereby the washing of clothes may be accomplished thoroughly and quickly.

A washing machine has been patented by Mr. Jeremiah Biddison, of Moscow, Idaho Ter. Combined with a tub having a reciprocable pounder is a frame with a mortise in one of its cross bars centrally mounted upon the heads of the pounder and adapted to be reciprocated between the sides and over the ends of the tub, with over novel features, making a machine of simple construction and very efficient in operation.

A brick kiln has been patented by Mr. Jacob Buhrer, of Constance, Baden, Germany. It is provided with a series of chambers, gas generators and gasometers, and with air and gas conduits, arranged in a novel way, whereby one portion of the kiln may be isolated from other parts, and two chambers may be fired at once, securing a larger production of brick, tile, terra cotta, etc.

Special.

HEARTS.

Until within a few years the diseases of the heart and of the system were in nearly all cases reached through the stomach, for the doctors said: "*We cannot, of course, reach the heart directly. How can we?*"

This question, asked twenty-five years ago, was only partially answered—it was only guessed at—until the discovery of "Compound Oxygen." Drs. Starkey & Palen, the physicians who have been so successfully administering this remedy, answer the question by telling of their experience. They call attention to the fact that *on the completion of the circuit of the system, all the blood which has been thrown out by the heart comes back to the heart by the way of the lungs. Here it finds a great field for aeration, exceeding in area the entire outer surface of the body. Here, with the air, the oxygen reaches the blood. The returning blood, entering the heart invigorated, adds new vigor to that organ, and, with less effort, a greater volume is sent forward, carrying vigor and comfort through all the arteries and veins in its circuit.* This is a very brief statement of the method of cure by Oxygen. But a reading of the letters of patients who speak of the comfort the Treatment gave them, of the relief of heart trouble, and of the ability to sleep, after being for months or years deprived of it by palpitation or fluttering of the heart, will be the best evidence that could be produced that the right method of cure for disease has been found in "Compound Oxygen." And the value of the statement will not be decreased by its brevity.

The curiosity as to what Compound Oxygen is may be gratified by any one who will take the trouble to write a postal card or letter of inquiry to Drs. Starkey & Palen, at 1529 Arch Street, Philadelphia. They publish a brochure of two hundred pages, entitled *Compound Oxygen—Its Mode of Action and Results*, which will be sent free.

Business and Personal.

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

NEW BOOKS AND PUBLICATIONS.

THE ENGINEER'S CATECHISM, A PRACTICAL TREATISE FOR THE USE OF THOSE IN CHARGE OF STEAM PLANTS. By George L. Fowler. New York: American Railway Publishing Company. 1888. Pp. 183. Price 50 cents.

This work is intended as a book of instruction for engineers in charge of steam plants, as to the most approved methods to be employed in the prosecution of their duties. It is in the form of question and answer, and will prove a useful little work for regular engineers as well as for those preparing for examination. Its low price should assure it a large sale.

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) G. W. S. asks: 1. What material can I use to make a small model engine, that is easier cast than cast iron, and will work equally as well in the lathe and in the engine? Of what material, and in what way, can I make a small air tight valve, that will hold without leaking a cold air pressure of 10 to 15 pounds? A. For model engine and air tight valve use brass or type metal. The valve may be given a metal seat perforated with a number of small holes and closed by an India rubber flap. 2. What is the simplest chemical I can use that will be affected by light passing through a negative placed over it? Don't want a perfect image, or any shading or half tints. A. For chemical affected by light, you may use chloride or bromide of silver, or a solution of gelatine containing 10 per cent of bichromate of potash dissolved in it. 3. What is the best form of condenser now in use in connection with the steam engine for producing a vacuum in the cylinder? A. The surface condenser is the general type of condenser now adopted. 4. Was the device for cooking with the heat of an ordinary oil lamp, where the food was placed in an air tight vessel surrounded by water kept hot by the lamp, a practical arrangement, or mere supposition? An account of it was published some time since by Mr. Atkinson, I believe. A. The device for cooking was considered practical by its originator. 5. What material can I use to cast small articles, that is somewhat stronger than Babbitt and will bear being drilled and tapped? A. For small castings use brass or bronze for good work, and type metal where easy fusibility is an object.

(2) R. C. asks: 1. How to make say a half gallon of the solution for nickel plating as described on page 10 of the present volume of the SCIENTIFIC AMERICAN? A. For slightly over a half gallon solution, use nickel sulphate one-fifth pound, ammonium tartrate one-seventh pound, tannic acid one one-thousandth pound, water one-half gallon. 2. Would four cells of Grenet battery with zincs 2 inches by 2 inches and six electric light carbons each be large enough for plating small articles? A. Yes; connect in series, zinc to carbon. 3. What solution would I need for dipping the articles to be plated in, to make the plating adhere? A. The articles must be scoured with ground pumice, whiting, or similar material and water, then dipped in warm potash solution, again scoured, and immediately before insertion in the bath dip into an acid solution or cyanide of potash solution. For

potash solution use a half pound to a gallon; for acid solution use sulphuric acid 4 pounds, nitric acid 2 pounds, water 4 pints: for cyanide of potash solution use ½ pound cyanide of potassium to 1 gallon of water. You should not attempt to work at it without having a good manual on the subject, such as Watt's "Electro-Deposition of Metals," which we can send you by mail for $3.50.

(3) G. J. P. asks: 1. What acids and in what proportion will etch type metal? A. Take nitric acid 1 part, water 5 parts. Mix. 2. How is the colored lacquering done, such as used on the inside of small glass balls and toys, for Christmas tree decoration, etc.? It is of all colors and remarkably brilliant. A. The cheaper colored balls contain a quickly drying colored varnish or paint put into the ball and distributed by turning the globe about. 3. Where to get fatty ink spoken of in your paper, and used for drawings in etching zinc plates? A. The manufacturers of fine printing inks will furnish such an ink.

(4) A. P. S. writes: I read that if steel is immersed in carbonate of potash for a few minutes it will not rust for years, even if exposed to a damp atmosphere. Could it be applied to gun barrels or locks, without injury to the same, and would subsequent oiling affect the result? A. The carbonate of potash only neutralizes any acid that may be upon the surface of steel or iron, and while it remains as a film, neutralizes the oxidizing properties of moist air in contact. Oiling with neutral oil (free from acid, preferably linseed) will further protect the surface. Any wiping of the articles or handling the surfaces covered by the carbonate destroys its protecting properties. It will serve but little good on a gun barrel that is handled. Frequent oiling and wiping is recommended.

(5) A. C. R. writes: I have some rattan baby carriages that have become soiled. I wish to stain them cherry color. How can I do it? A. For cherry stain, take of rain water 3 quarts, annatto 4 ounces; boil in a copper kettle until the annatto is dissolved, then put in a piece of potash the size of a walnut, keep it on the fire about half an hour longer, and it is ready to bottle for use. 2. I have a lot of kerosene lamp burners that have become black and soiled. What is the cheapest way to make them look bright? A. Use oxalic acid and whiting mixed and applied wet, with brush, and brushed again when dry with soft plate brush to polish.

(6) H. & W. ask: We have connected with our planing mills a dry kiln for lumber, which we dry with hot air. After this hot air has passed through the lumber, we convey it into the shop for heating purposes. Do you consider this manner of heating shops healthy, especially after the hot air has passed through a kiln of green pine? A. We should think it was healthy.

(7) R. W. asks: Granted a vessel weighs 10 tons, *i.e.*, displaces 10 tons of water, is it not possible to float that vessel in much less than 10 tons of water in a lock or shell? Will her water line not remain the same? Is it not theoretically correct that the Great Eastern may be floated in a pail of water? A. Yes, to all the queries.

(8) G. J. H. asks: A good receipt for blacking the inside of a photograph camera and bellows. A. The proper black for inside optical work is made with shellac varnish. Mix lamp black with pure alcohol to the required thinness, and add a few drops only of shellac varnish, just enough to make the lamp-black stick without being shiny. Make a little trial on paper, as you are adding the shellac, to get the exact proportion. 2. My camera is made of Spanish cedar. Please give me a receipt for polishing same. A. Oil the box with boiled linseed oil and dry, and finish with French polish. We can send for 25 cents French Polisher's Manual on staining and polishing of wood.

(9) R. writes: A bets B that four 1 inch pipes will radiate more heat than one 4 inch pipe. Who wins? A. A wins, according to arrangement of pipes.

(10) T. H. asks: How is emery made to adhere to leather? Is common glue used, or is there a waterproof cement used? A. Use the strongest glue, rather thick; brush on the leather even, and sprinkle the emery over; press it down with a block or mallet. When finished and dry, the surplus will fall off.

(11) J. F. N. asks how to coat small iron articles with black enamel or varnish such as is used on small buckles, etc. A. String the articles on fine wire, and dip in thin japan varnish. Bake in an oven or box heated to 260°, steam heat is safest. Care should be had that the vapor from the varnish does not come in contact with fire.

(12) A. B. asks: Is there any way of treating soft rubber so that grease will not affect it? A. There is not.

(13) E. H. desires the process of preserving natural flowers by the wax solution process. A. Dip the flowers in melted paraffine, withdrawing them quickly. The liquid should only be just hot enough to maintain its fluidity, and the flowers should be dipped one at a time, held by the stalks, and moved about for an instant to get rid of air bubbles. Fresh cut flowers, free from moisture, make excellent specimens in this way.

(14) S. R. B. asks how to tan a swan's skin without injuring the down. A. Thoroughly impregnate the fibrous part with a mixture composed of 4 parts alum and 1 part pepper and saltpeter. See "The Taxidermist's Manual," which we can send you, post paid, for $1.25.

(15) E. H. asks a good receipt for making ink for use on stamp pads. A. Use an ink consisting of aniline violet ¼ ounce dissolved in 15 ounces alcohol and 15 ounces glycerine added. If you prefer other aniline colors, they can be used instead.

(16) J. J. C. asks how to silver-plate a door plate and bell, by using a powder or liquid. A. Mix 1 part chloride of silver with 3 parts pearl ash, 1½ parts common salt, and 1 part whiting, and rub the mixture on the surface of brass or copper, previously well cleaned, by means of soft leather or a cork moistened with water and dipped into the powder. When properly silvered, the metal should be well washed in hot water, slightly alkalized, and then wiped dry.

(17) J. E. P. asks: How are lead bullets polished? A. By being revolved in a cask containing black lead or plumbago.

(18) C. M. R. asks: What will restore the appearance of red brick walls, and make them look fresh and new? A. Use a red wash made by melting 1 ounce glue in a gallon of water; while hot, put in a piece of alum the size of an egg, ½ pound Venetian red, and 1 pound Spanish brown. Try a little on the bricks, let it dry, and if too dark, put in more water; if too light, add more red and brown. 2. Can diamond dyes be dissolved in anything so as to be used to paint lantern slides? A. Dissolve in alcohol. Lantern slides are painted with very thin colors, and generally not with aniline paints.

(19) J. A. V. desires (1) a good receipt to prevent water from having a disagreeable taste. A. Mix it with charcoal and filter; this will render it both colorless and odorless. 2. How to make collars stiff and glossy. A. Pour a pint of boiling water upon two ounces of gum arabic, cover it, and let it stand all night. Use a tablespoonful of this to a pint of starch.

(20) D. R. writes: We have plenty of theories as regards the sources of heat, but no one tells us satisfactorily whence the cold comes from, or accounts for the intensity of cold. A. Cold is the absence of heat, or the elimination of the vibrations that cause heat. Heat vibrations are supposed to have their limit at 459° below zero.

(21) H. H. S. asks: How can I give a high glaze to an oil painting? A. Use the following varnish: Take of mastic 6 ounces, pure turpentine ½ ounce, camphor 2 drachms, spirits of turpentine 19 ounces. Add first the camphor to the turpentine; the mixture is made in a water bath. When the solution is effected, add the mastic and the spirits of turpentine near the end of the operation; filter through a cotton cloth.

(22) A. K. asks what washing compounds (powders), such as "pearline," "soapine," etc., are composed of, and how compounded. A. The exact composition can only be ascertained by analysis, but their detergent qualities are due to pearl ash, soda ash, and similar alkaline compounds.

(23) C. asks (1) the best and quickest way of making vinegar in quantity. A. See process described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 313. 2. The best way to make acetic acid without distillation. A. The simple oxidation of alcohol produces acetic acid. Treat alcohol in the same way as you would cider, to produce vinegar. In fact, vinegar is only an impure acetic acid.

(24) F. J. S. asks: What will keep tents from mildewing in warm weather? A. Use a mixture of solutions of alum and sugar of lead.

(25) J. N. G. desires a cure for bunions. A. An inflamed bunion should be poulticed, and larger shoes worn. Iodine 12 grains, lard or spermaceti ointment ½ ounce, make a capital ointment for bunions. It should be rubbed on gently two or three times a day.

(26) F. T. asks: What will take oil stains and rust stains out of marble? A. Apply common clay saturated with benzine. If the grease has remained long enough, it will have become acidulated, and may injure the polish, but the stain will be removed.

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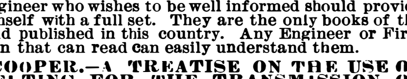

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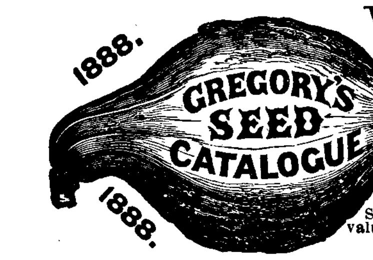

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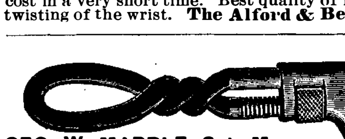

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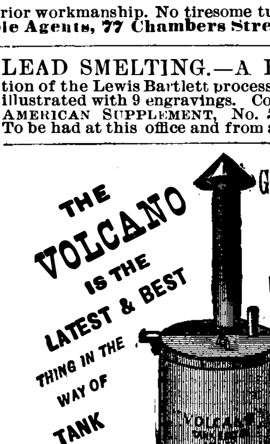

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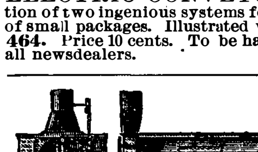

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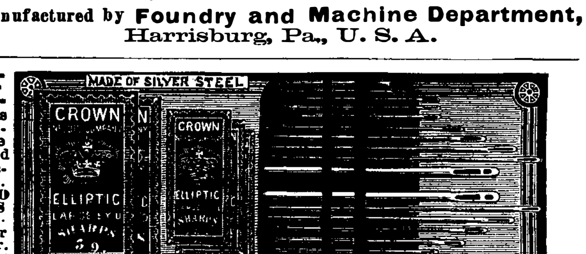

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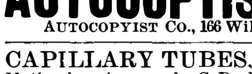

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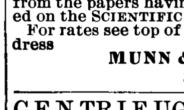

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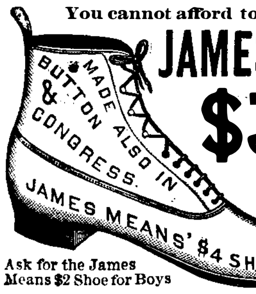

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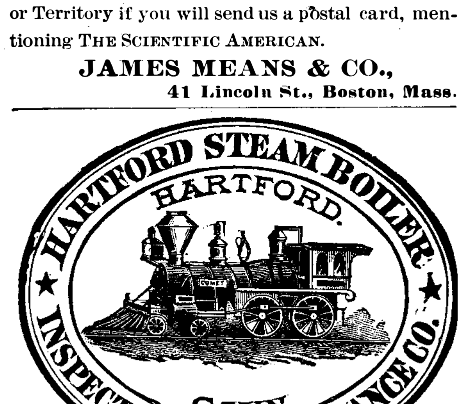

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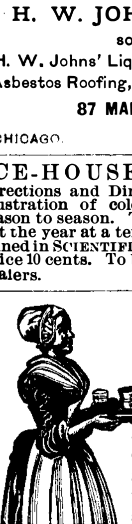

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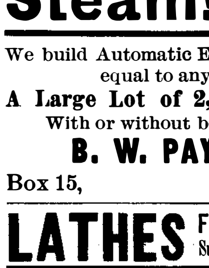

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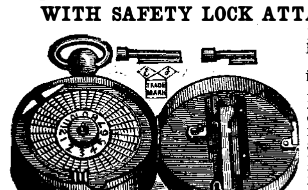

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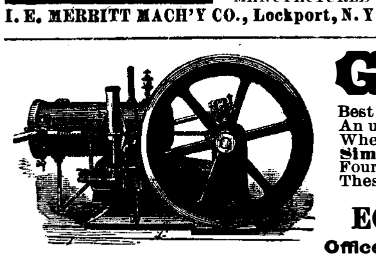

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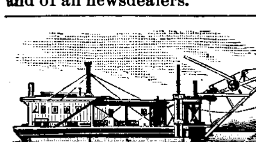

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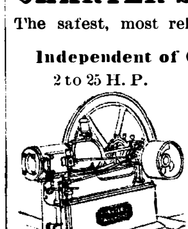

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