SCIENTIFIC AMERICAN

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

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

Vol. LII.—No. 12. [NEW SERIES.] NEW YORK, MARCH 21, 1885. [$3.20 per Annum. [POSTAGE PREPAID.]

ENGINES OF THE ITALIAN RAM ETNA.

The Italian navy is now supplied with several vessels of the most formidable construction and armament. Among others is the ram Etna. The engines of this ship have 7,700 indicated horse power. They are the latest English type of compound engines; the general arrangement will be readily understood by a glance at our engraving. The engines were built by R. & W. Hawthorn, Newcastle-on-Tyne.

To Retin Old Copper.

Take some common clay and mix with it salt and sal ammoniac, say one-tenth part of salt and one-twentieth part of sal ammoniac. Or take the dry clay, pound it up fine, then salt it to taste, as the cook books say, and mix it into a soft paste with strong sal ammoniac water. Spread some of this paste on a piece of old copper, place over a charcoal fire, and heat to redness. If the paste takes off all the old tin or solder, it is all right; if not, make it stronger by sprinkling on more powdered sal ammoniac and salt until it is strong enough. The copper can be cleaned by scouring with salt and sand, and should be dried by being plunged into dry sawdust and rubbed until it is perfectly dry, or the air will form oxide of copper on the surface.

To tin the copper have a dish of powdered sal ammoniac and a bunch of tow—nothing else will do as well. Wet the surface of the copper with ordinary soldering acid, into which a little powdered sal ammoniac has been dissolved. Place the article over a charcoal fire (an old dripping pan with the bottom punched full of holes set on two bricks will do well), and as soon as the copper is hot enough to melt the tin or solder, which is supposed to have been put on, rub over with the bunch of tow, which is to be frequently dipped in the powdered sal ammoniac, and the copper will look as good as new, and perhaps better. If the copper is allowed to get too hot, the tin will look yellow. Do not get in a hurry, but try to have the copper at an even heat, and you will have a good job. If the article has had holes soldered in it, hold over the fire before using the paste, and wipe off the old solder.—*The Ironmonger.*

Water Blasting.

The value of water as an aid to blasting when used in connection with explosives is rapidly becoming recognized in this country, as well as in the larger mines and quarries of Europe. Ordinary blasting with gunpowder in coal mining is done by boring a hole in the face of the coal about two inches in diameter and four or five feet deep. Into this is inserted the powder cartridge, together with the slow fuse, when the hole has been well tamped, filled with any dry refuse rammed in tight, then fired by lighting the fuse. In this operation (and we have described it thus not to show any new ideas connected with it, but for comparison) a very dangerous flame, especially in gaseous pits, is created, and appalling results often ensue; carbonic acid and sulphurous acid gases are generated, very dangerous to miners and to mining properties. When it is desired to blast with water together with gunpowder, the process is conducted by inserting into the bore hole a powder cartridge with the fuse attached as in the ordinary way; next to the powder cartridge is inserted into the bore hole a tube containing water. These tubes must be as large as the bore hole will admit, and of any length convenient to handle, the larger the better; they may be made of any cheap material convenient, cheap thin tin plate, or stout brown paper turned around on a wooden roller, after being well pasted together, the ends closed with corks. The bore hole is now tamped in the ordinary manner, the fuse lit, and the cartridge fired in the usual manner. As a result of this process the following points of excellence, among many others, may be briefly mentioned: the powder, in exploding, bursts the tube containing the water, and, careful estimates show, with increased power or explosive violence, as the rending force is extended through the water in accordance with the well known principles of hydrostatics practically demonstrated years ago by Brahma, over the enlarged interior area of the bore hole, due to the space occupied by the water tube. A much larger quantity of the material to be mined or quarried is thereby brought down or loosened with a smaller quantity of the explosive used. The heat given off by the burning of the powder and surrounding gases converts a larger proportion of the water into steam, the elastic force of which assists in the operation of blasting; the steam and remaining water together extinguish the flame and flash of the powder, and absorb and neutralize the greater portion of the gases and smoke resulting from explosion. It will readily be seen that by this process are met together economy, power, and safety, the system being simple and effective and not attended with anything inconsistent with the well known laws of explosion. It is to be hoped that, in the best interests of humanity, our large and intelligent body of miners and quarrymen will not be slow to adopt an amelioration in the present crude and dangerous processes of blasting which will tend, in no small measure, to render premature explosions in mines a thing of the past, rather than one of almost daily occurrence.—*Coal Trade Journal.*

The Petrified Forest.

The visitor to the petrified forest near Corizo, on the Little Colorado, will begin to see the signs of petrifaction hours before he reaches the wonder; here and there at almost every step in the road, small pieces of detached limbs and larger stumps of trees may be seen almost hidden in the white sand. The road at a distance of ten miles from Corizo enters an immense basin, the slope being nearly a semicircle, and this inclosed by high banks of shale and white clay. The petrified stumps, limbs, and, in fact, whole trees, lie about on all sides; the action of the waters for hundreds of years has gradually washed away the high hills roundabout, and the trees that once covered the high tablelands now lie in the valley beneath. Immense trunks, some of which will measure over five feet in diameter, are broken and scattered over a surface of 300 acres.

THE youngest member of the Cotton Exchange in this city is a youth of fifteen summers, and the oldest a veteran of eighty-two years.

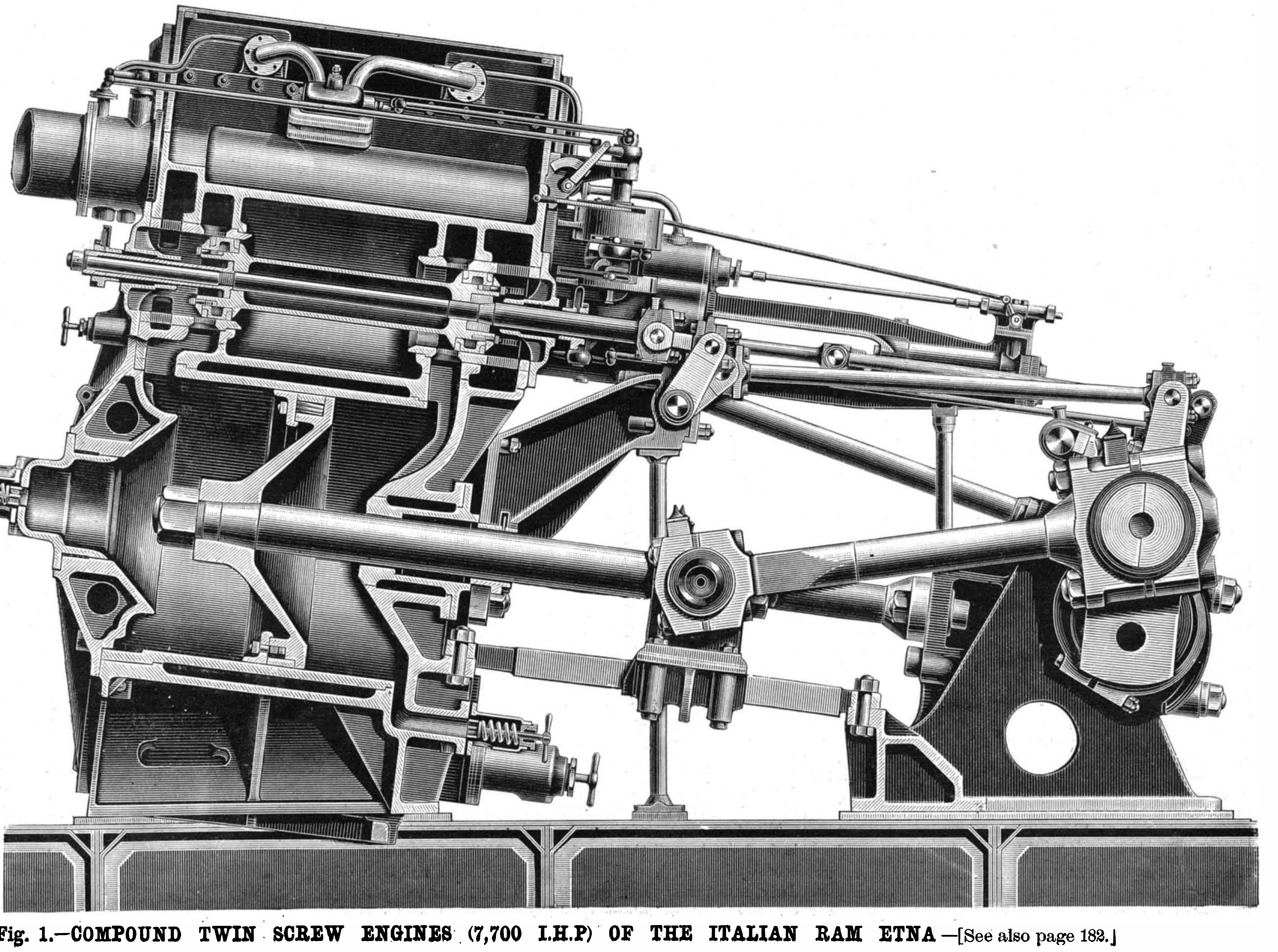

Fig. 1.—COMPOUND TWIN SCREW ENGINES (7,700 I.H.P) OF THE ITALIAN RAM ETNA.—[See also page 182.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, MARCH 21, 1885.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT,

No. 481,

For the Week Ending March 21, 1885.

Price 10 cents. For sale by all newsdealers.

PERSONAL KNOWLEDGE.

Hidden or occult knowledge might have been once a part of the mental paraphernalia in which scientists dressed their discoveries and inventors concealed their improvements. But occult knowledge is not a thing of the past, even in these days of mechanical exactness and experimental demonstration. It is possible for a workman to hold some method or process so securely that, even if willing, he may find it difficult to impart it to a learner. This statement does not refer to "tricks in the trade" which are mere mountebank pretensions, but to real knowledge of absolute value that cannot readily be imparted. When a man is found who possesses this knowledge in any department of mechanics, he is a valuable man; what he knows on his own specialty he knows thoroughly. There can be no question that Cicero's statement, "*Poeta nascitur, non fit*," is an absolute truism when applied to some workers in mechanics—they are not made, but they were born, mechanics.

Illustrations of this fact are probably familiar with many experienced and elderly mechanics. There is a tool maker in an extensive establishment in which coiled springs of steel wire are largely used. The springs are wound from the annealed wire, and after being completed are hardened and tempered. Some of them are "open" and some are "close" springs. Out of 22,000 springs, of which an account was kept in consecutive workings, only six springs failed the severe trial test. The temperer was unwell and out for eight working days, and of the springs hardened and tempered by the assistant, who had a year's instruction, less than one-half passed the test. In this case the writer has reason to know that the temperer had used his best endeavor to have his assistant his ultimate successor. Some lack of sensible impression made by heat and color on feeling or on sight must have been the cause for the difference between the result of the assistant's work and that of his teacher.

There is an old machinist now living, but superannuated, who was famous in his day for his superior hand-made edge tools. A pocket knife with a restored blade of his workmanship was doubled in value because he had made it. This was before the manufacture of cutlery had been attempted in this country. His two sons succeed him, but they have never been able to equal their father in this direction.

At a large manufactory of sword blades for army purposes, masonic and other regalia, one man has tempered them for many years. Although he has been engaged in other business for years, he is called whenever a batch of blades are to be tempered. Although he is willing to impart verbal instruction and help a learner, he has never had a pupil to equal him.

There is a large scythe manufactory in a New England town, making 14,000 dozen scythes a year, and the president of the company has for years hardened and tempered every scythe that leaves the works, because no other man in the works can do it so well.

COMETS AND ASTEROIDS OF 1884.

The past year does not present a record of numerous or brilliant additions to the cometary family. Although six comets have some claim to a place on the list, there are but two that strictly fulfill the conditions of comets newly discovered whose perihelion occurs during the year.

The first cometic excitement took place on the 7th of January, when Ross, an amateur observer at Elsternwick, near Melbourne, Australia, discovered one of these celestial will o' the wisps. Its characteristics were of the negative order. It was very faint and very small, had scarcely any central condensation, and was destitute of that essential cometary appendage, a tail, a small projection supplying the deficiency. It was invisible in the northern hemisphere, and was only seen for a month. Moreover, it had passed perihelion on the 25th of December, 1883, about a fortnight before it was picked up. It has no claim therefore to be ranked with the comets of 1884, but will go down to posterity as a possession of the year 1883.

The first comet of the year in the order of perihelion passage was in reality a rediscovery, though the fact was not recognized at the time. It was detected by Brooks of the Red House Observatory, at Phelps, New York, on the 1st of September, 1883. It was afterward found to be identical with the comet discovered by Pons in 1812, which having completed its long journey of 70 years had returned once more to the clime of the sun. Great was the rejoicing over its advent nearly at the predicted time, and great the satisfaction it afforded in proving that the men of science had made no mistake in laying out the path of the erratic visitor. It took rank as comet *a* 1884, but is better known as the Pons-Brooks comet. It reached perihelion on the 25th of January, and therefore ranks with the comets of 1884.

The first comet of the year in regular standing, that is, in fulfilling all the required conditions, was discovered by Barnard, of Nashville, Tenn., on the 16th of July, and takes rank as comet *b* 1884. It was a telescopic object, nebulous, slightly condensed, and passably bright, but not of much account among its class. There are, however, points of interest in its history. It travels in an elliptical orbit, and has a period of about five and a half years. The closest scrutiny has been unable to detect its appearance at any previous period, though its elements resemble those of comet I 1844, discovered by De Vico. The comets are not thought to be identical, as the interval of time does not correspond with any integer of periods, and De Vico's comet, when similarly situated, was easily visible to the naked eye. Comet *b* 1884 reached perihelion on the 16th of August, and, if nothing happens to turn its course, may be expected to make another visit in 1890.

The third cometary prize of the year was the most important, not, however, on account of its size or brilliancy. It was discovered on the 17th of September, by Wolf, a student at Heidelberg, Germany, and is still visible. An observer at Dresden describes its appearance on the 21st of September as 2′ in diameter, strongly condensed toward the center, and with a stellar nucleus about equal in magnitude to a star of the 8th magnitude. It was in perihelion on the 24th of November, and will take its place on cometary annals as comet *c* 1884. It was seen on the 21st of October in Alexandria, Egypt, with the naked eye, appearing as a nebulous body condensed in the center and without a tail.

This speck of a comet has proved to be a celestial rover of great interest to astronomers and amateurs. It was found to move in an elliptical orbit with a period of about six and a half years. Diligent search was made to find if it had ever paid us a visit before. Not a trace of its presence could be detected, and no orbit of any known comet bore any marked resemblance to that of the new comer. Where was it in 1871, or in 1878, or how came it in our sky in 1884?

The planet Jupiter solved the mystery. In 1875, when this comet was far away from the earth, it ventured near the giant of the system. Quick as a flash, it was tumbled out of its former path, and made to travel in a new one. We are indebted to this little incident for its appearance in our sky, and, if it keep away from "the great comet disturber," as Jupiter is called, we may hope to see Wolf's comet again some time in 1891.

There was precisely the same condition of affairs with Lexell's comet of 1770, which passed near our big brother, both before and after its advent in our domain, was made to travel in a different path by the force of his attraction, and has not since been seen.

The fourth comet to make us a visit in 1884 was Encke's comet, our oldest friend among comets of a short period, and one that has not failed to reappear once in about three and one-third years for almost a century. Although this comet was seen early in December, 1884, as its perihelion passage occurs on the 7th of March of the present year, it will take rank among the comets of 1885.

The fifth comet of the year may be appropriately called the suspicion of a comet. Tuttle's comet of 1858, with a period of six years and a half, was due in 1884. Schulhof, who determined its period, and computed its elements, announced its probable return some time during the summer, after three unobserved returns in 1864, 1871, 1877. An observer, using the great refractor of the Vienna Observatory, saw on the 26th day of May a faint nebulous object very near the comet's computed track, which may have been the comet itself and not a nebula. Unfavorable weather prevented further observation, and, when again the sky was cloudless, the shadowy object was no longer visible, nor could it afterward be found. Thus it will never be certainly known if a single observer had a fitful glimpse of our old friend of 1858. The year 1890 must roll into place before we can hope for a return.

One more comet of a short period deserves mention on the cometic records of 1884. Brorson's comet, with a period of five and a half years, discovered in 1846, and last seen in 1879, was expected to make its perihelion passage in September. It was not favorably situated for observation, and the keenest eyed observers did not succeed in picking it up. It will be due again in 1890, when it is hoped that those who are specially interested in periodic comets will have the pleasure of beholding it.

THE ASTEROIDS OF 1884.

During the year 1884, nine new asteroids were added to the troublesome and heterogeneous family, making the whole number of members 244. An additional asteroid was supposed to have been discovered on the 27th of October, by Palisa. It ranked as No. 245, but turned out to be identical with No. 208, Lacrimosa.

The following list introduces the nine new members. Two of them have not yet been honored with names, a fact not to be wondered at when considering the inconveniently large size of the family.

No.	Name.	Discoverer.	Place.	Time.
236.	Honoria.	Palisa.	Vienna.	April 26.
237.	Hypatia.	Palisa.	Vienna.	June 27.
238.		Knorre.	Berlin.	July 1.
239.	Adrastia.	Palisa.	Vienna.	August 18.
240.	Vanadis.	Borelly.	Marseilles.	August 27.
241.	Germania.	Dr. Luther.	Dusseldorf.	Sept. 12.
242.	Kriemhild.	Palisa.	Vienna.	Sept. 22.
243.	Ida.	Palisa.	Vienna.	Sept. 29.
244.		Palisa.	Vienna.	Oct. 14.

STEERING THE ALASKA.

In the SCIENTIFIC AMERICAN of March 7th last, we gave engravings of the steamer Alaska, showing the late mishap to her rudder. It will be remembered the accident consisted in the breaking in two of the rudder at the upper part, leaving the lower part intact, and available for use provided any means could have been devised to work the same. The propeller and machinery of the ship—11,000 H.P.—remained in good order, but for want of means to steer, the great ship was in danger of being lost with all on board, her officers and crew being unable to improvise anything by which steering could be effected, although they resorted to spar drags and the ordinary contrivances. At last they met another steamer, which by agreement was taken in tow and used as a steering drag behind the Alaska, which then steamed ahead, and in this manner, using the towed steamer as a rudder, port was duly made. For the privilege of using this steamer as a drag for four or five days, it is reported the Alaska company will have to pay two hundred thousand dollars.

We asked of our readers whether any of them could suggest any other available plan whereby the Alaska might probably have been steered; and in response we have received a number of replies, some of which we now present, and in following numbers shall doubtless give others. The problem is well worth discussing. Those who wish to take part in it should examine the engravings of the Alaska and particulars we gave March 7. The safety of ships at sea is one of the most important of subjects, and whoever can offer anything useful in this direction may be regarded as a benefactor.

Among the replies so far received have been quite a number in which new devices for steering have been proposed, involving new machinery or appliances not applicable to the emergency in which the Alaska was placed. With regret we shall have to omit most of these contributions as not pertinent to the present question.

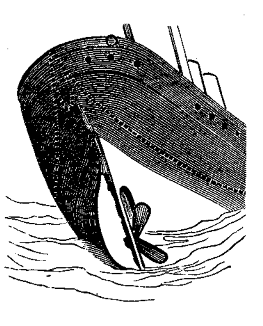
But it is proper to observe that the present devices for steering great ships are deficient, and there is need for new and useful inventions in this line. The same remarks apply to all kinds of life-saving appliances, to the construction of vessels to prevent them from sinking, and to all departments of marine construction and manipulation.

With respect to some of the plans below presented, the question will naturally arise whether the authors have fully considered the difficulty of getting at the rudder in order to attach their devices. It would seem to be no ordinary task to attach clamps or pass in ropes upon a flapping twelve ton rudder, under an overhanging stern, rising and falling amid crashing waves.

The Alaska's Rudder.

To the Editor of the Scientific American:

The problem of the steamship Alaska's rudder is a study. It seems to me, if the officers of the vessel had carried the anchor cables to the stern of the vessel, as indicated by the dotted lines in the sketch, then formed a loop of another cable, say about one-third the length of the lower part of the rudder, and attached the anchor cables one on either side, and if necessary attached an anchor to keep the chains from masting or swinging too easily in the waves, now we are ready to grapple with the dangerous rudder. Lower the loop from the stern of the vessel to the center of the broken piece, and as you draw forward by the anchor cables the loop will naturally open and draw over the outer surface of the rudder; and when the cables get tight, one on either side of the vessel, the rudder will be firmly bound and perfectly secure, after which the vessel would be easy to handle by the use of the sails and other appliances at hand. Of course the power to draw the cables would be the same as to lift the anchor. CHAS. H. OTIS

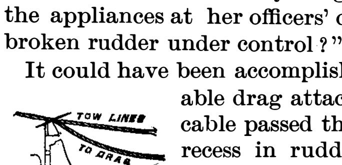


Shelton, Conn.

To the Editor of the Scientific American:

In the last number of the SCIENTIFIC AMERICAN, in an article entitled "The Alaska's Rudder," the question is asked: "Could anything have been done with the appliances at her officers' command to bring the broken rudder under control?"

It could have been accomplished, I think, by a suitable drag attached to the rudder by a cable passed through the semicircular recess in rudder over the end of the journal of the propeller, the end of the cable being fastened between the drag and the rudder. The speed of the vessel would throw the drag directly astern, and by running a towline from each side of the vessel to the drag, and relaxing one and drawing the other, the drag would be deflected and the rudder turned toward the taut hawser, bringing it under very fair control. With a cable of proper length there would be but little danger, even with the most violent action of the sea on vessel and drag, of throwing the broken rudder above the length of its pintles, and so detach it. With care the fractured end of the rudder post might have been kept over that of the rudder, at least a part of the time; and even if not, its weight of nine or ten tons and little buoyancy would keep the rudder on its bearings.



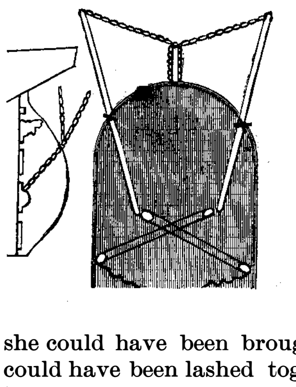
By this arrangement I can see no reason why the steamer could not have been quickly put upon her course, and run to port with comparative ease and little danger. A. E. F.

Cleveland, Ohio, March 9, 1885.

The Alaska's Broken Rudder.

To the Editor of the Scientific American:

Reply to the problem, "How would you have gone about to solve it?" An attempt ought to have been made to run a chain cable through under one of the hinges, second one below the break if possible; then crossed and running up to two spars rigged over the stern and secured, blocks made fast to the forward end of spars, would have made a steering gear of sufficient strength and one easily handled, by which she could have been brought into port. The chains could have been lashed together at the place of crossing. L. K. F.

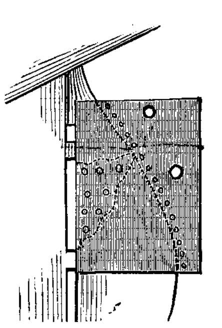


Brattleboro, Vt.

Temporary Repair of the Alaska's Rudder.

To the Editor of the Scientific American:

Western steamers generally carry extra pieces or sheets of boiler iron, blacksmith's forge, with facilities for making bolts, drilling holes, and so on. I suggest to take two plates of iron, of whatever size could be found, and put wood between the thickness of after edge of rudder. If wood the right thickness could not be found, boards could be put together to get the right thickness. Bolt the iron on each side of the wood with bolts of sufficient strength and numbers; let iron extend over the wood on the rudder as far as the pintles would allow it to go, so as not to hinder the rudder turning either way; drill holes through the plates so as to come over the fracture, for that is all the place bolts could be got through the rudder blade. This could be lowered over the stern of the vessel with ropes from each side, so as to guide it to the place with two other ropes fastened lower down to pull it forward into place. After it was started on the rudder blade, the bolts might be left a little slack until the plates were put in place, so as to avoid any trouble getting the clamp started. Of course a favorable time would have to be selected to do this work when the sea was a little calm.



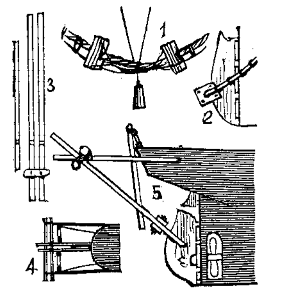
Inclosed find a drawing to exemplify above. G. W. COFFIN.

Pittsburg, Pa., March 7, 1885.

Catching the Loose Rudder.

To the Editor of the Scientific American:

I noticed your invitation for suggestions as to way of catching the loose rudder of the Alaska. I have made a pencil sketch of plan I would try. I should take a hawser, and rig it like Fig. 1, which shows a hawser with two blocks upon it. These blocks I would make of plank, and two or three pieces, and cross the grain when I put them together, and they would have to be put together upon the hawser, and left so they would just slide freely. Then I would have four leaders screwed on so that I could use a good strong line to move the blocks, and would slush everything well that I expected to move. When all ready, I would have hawsers dropped over stern with blocks pretty far apart, so as to take in whole width of rudder, and would probably use the deep sea lead or some other weight to carry the bight of my hawsers down; would watch chance, and take advantage of movements of ship, and catch rudder between the blocks, as shown in Fig. 2. I might not catch on the first time, but feel sure that I would be successful in a short time. With rudder caught, I should consider it plain sailing. I would take my spare spars, and with two of them make a pair of tongues, Fig. 3, and with others rig out like Fig. 4, and set up like Fig. 5, and with the proper ropes, block tackles, etc., any *sailor* will make her work. The tongues work a tiller, and while the movement of the rudder would be less than its usual limit, yet it would be sufficient to steer. I came out of the Arctic Ocean through Behring Straits once with our rudder so loaded with ice that we could only get a *quarter movement*, and yet we made a dangerous passage without any trouble. JOHN A. PAUL.

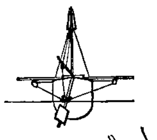


Huntingdon, Pa., March 8, 1885.

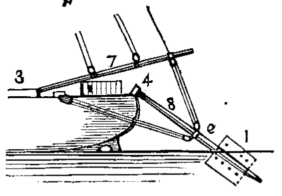
The Denmark's Rudder.

To the Editor of the Scientific American:

Having crossed the North Atlantic 38 times in the last thirteen years, I took great interest in your article on the Alaska's broken rudder. In reply to your inquiry, "Ingenious reader, what would you do?" I inclose cut of an improved rudder made by the captain of the national steamer Denmark, in March, 1878, with which the ship was safely and at a fair speed navigated from 45° west longitude to New York.



I have had a sketch of the device in my log book ever since, and have had the pleasure of seeing it copied by the captains of some of the best transatlantic steamers.



The following is a description of the contrivance:

1. Iron doors bolted on the end of the fore boom, the boom being swiveled, fastened, just above deck at 4.

3. Main saloon skylight cut, allowing the main boom 7 to pass in, and end lashed to deck beam.

5. Upper topsail yard, across deck, lashed between the after bits. Falls from both ends of the topsail yard lead to the fore boom at 9, serving on board over two blocks amidships and then on to the after winch. Taking opposite turns at the port and starboard ends of the winch, it was only necessary to run the winch ahead for a port helm and backward for starboard.

In severe weather the whole affair was cocked in the air by the top lift, and the vessel hove to.

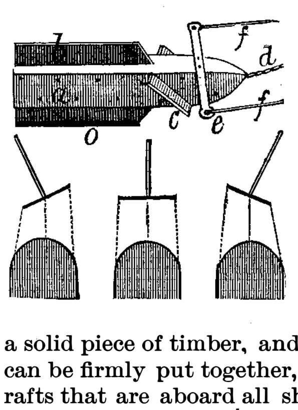
ROLAND R. DENNIS.

Poughkeepsie, March 10, 1885.

Steering the Alaska.

To the Editor of the Scientific American:

I have a device to offer, which, with the appliances at command of the officers of the Alaska, could have been constructed in a few hours, and which would have answered the purposes of the broken rudder. Let *a a* represent a stick of timber or a number of planks, nailed or bolted together to make a log, say twenty feet long, twelve inches thick, and eighteen inches wide; and if in making this log, instead of letting all the planks run lengthwise, we cross cut enough of them, say forty-two inches long, and place them diagonal across in the center of the log that we want to form, we will design two blades, *b b*, which will project twelve inches from the upper and lower side of the constructed log, so that they will answer for two center boards, as it were. Now weight the lower blade at *o* with a few old grate bars or other heavy material, then saw a slit three inches deep on each side of the log, so that we can insert the inclined blades, *c*, therein; these blades ought to be set on an incline of thirty degrees, and they ought to project 18 inches. Brace them on the underside, then strap or bolt on the iron or stout timber rod, *e*, on the ends of which insert a lash on the guy ropes, *f*; also fasten the rope or chain, *d*, to the forward end of the log, *a*, this end of the same having its sides tapered or wedge shape. I would suggest that the edges of all the blades be sharpened. If convenient, the device can be constructed out of a solid piece of timber, and by means of angle irons can be firmly put together, or by the aid of the life rafts that are aboard all ships, a device of this kind can be constructed. Now suppose the vessel is stopped and the apparatus is lowered overboard, and on striking the water the weighted blade, *o*, *b*, turns by gravity downward, and the upper one, being the lightest, keeps the device in that position; now fasten the rope or chain, *d*, in the center of the stern of the vessel, and after having connected the guy lines, *f f*, with tackle, one on the starboard and the other on the port side of the vessel, and after having allowed about fifty feet between the vessel and the device, the ship is started, and instead of the apparatus floating, as it has done, it will become immersed, and remain in that condition as long as the vessel is in motion; and if we now deflect the guy ropes by means of the tackle, we can proceed on our intended course.



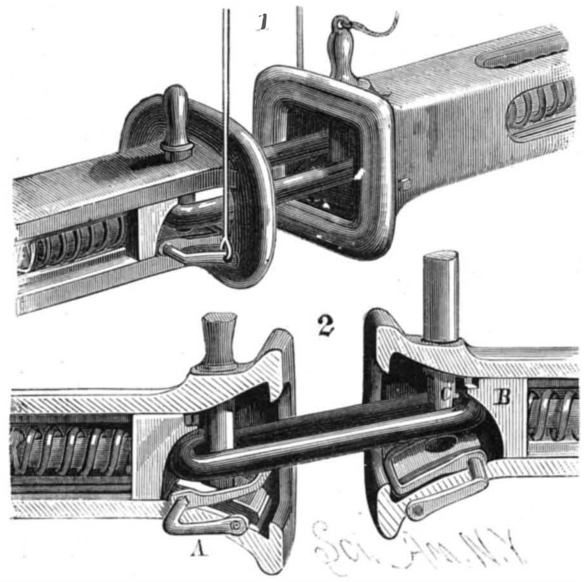
F. E. FORSTER.

1179 Third Avenue, New York City.

A NEW SAFETY COUPLER.

This coupling is both cheap and simple, and can be adapted to any car drawhead now in use that has a hollow back, and in "wrought drawheads," such as are used on the Lake Erie, Pennsylvania, and New Jersey Central railroads. Only three small pieces of casting and a spiral spring are required.

It can be put in an old drawhead without any



McKEEN'S NEW SAFETY COUPLER.

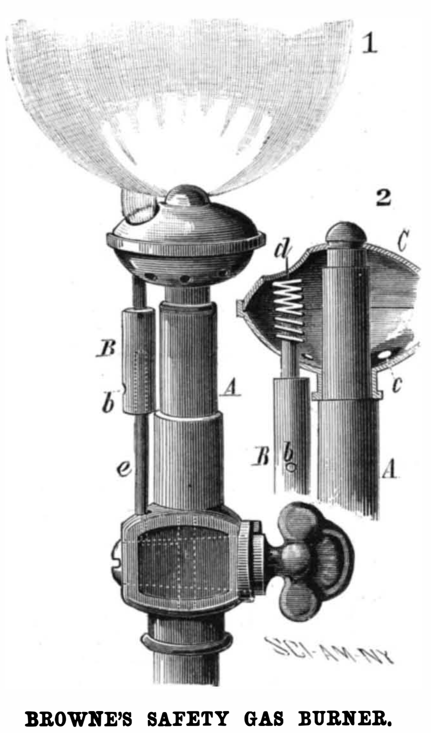
change except drilling two five-eighth inch holes, through which pass two short bolts, holding everything firmly to its place.

Although called a safety coupler, it is nearly, if not quite, automatic, especially in cast steel drawheads (which can be made quite light and not cost more than cast iron). It is merely a modification of an automatic coupler that was patented by the same inventor last spring, with one or two slight alterations to adapt it to the use of a pin instead of a hook, which was inserted in the drawhead.

One great advantage that this has is that it can be safely coupled to any of the old drawheads, whereas, in coupling a strictly automatic coupler to an old drawhead, there is more danger than in coupling two old ones together.

The link is under complete control from the top or side of the car; the pin is made so that it will stand on a follower plate which is pushed back by the link when the cars come together, thus allowing the pin to fall to its proper place.

When it is not desirable to couple, the pin can stand



BROWNE'S SAFETY GAS BURNER.

on top of the drawhead, yet it cannot be taken out or stolen.

This coupler also has a great advantage over one with a solid back, as when a pin happens to be down or the link strikes the opposite drawhead and does not enter the opening, it will not bend or break the link, the spring allowing it to be pushed back its full length into the drawhead.

Any information in regard to it, and of a trial that will soon be made, will be furnished by Mr. T. L. McKeen, the patentee, Easton, Pa., and models of either cast or wrought drawheads will be sent for examination to master car builders or superintendents of railroads.

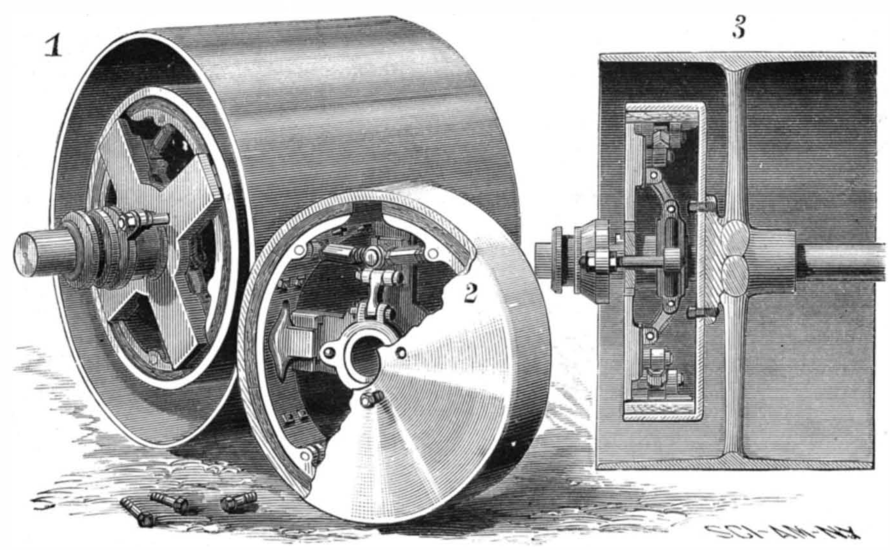
FLOATING saw mills are common on the lower Mississippi. They pick up the drifting logs, turn them into lumber, and sell the product to the planters along the shore.

An Icequake.

Madison lately had a tremor which was due not to a social or other earthquake, nor yet to a dynamite explosion. A disturbance which shook the university buildings was caused by the expansion and contraction of ice in Lake Mendota. Under the influence of intense cold the ice had expanded until the shores could resist the pressure no longer, when the ice burst and doubled up about four hundred feet from the shore, and on a line parallel with it. The sudden release of the shores from pressure caused the tremor. This phenomenon of freezing upon bodies of water having low shores frequently results in the piling up of huge rocks on the edge and the overturning of trees. The shore line of lakes frequently consists of gravel mounds forced up during successive winters.—*Milwaukee Wisconsin.*

AN IMPROVED FRICTION CLUTCH.

The mechanism herewith illustrated is intended to supply an improved contrivance for expanding and contracting friction segments carried on the side of a wheel fitted loosely on the shaft, in combination with the inner periphery of a rim or flange of a pulley or hoisting drum keyed fast to the shaft, thus making a simple and efficient friction device for hoisting and other machinery. In our engraving Fig. 1 shows the loose wheel as arranged in connection with the driving pulley, while Fig. 2 is an inside and Fig. 3 a sectional view showing the detail of the friction rim and the devices for expanding and contracting it. The expanding segmental sections have at their ends outwardly projecting flanges or stops, whereby frictional face strips are held thereon, these flanges holding the wood faces against being forced around the rims more effectually than they can be held by rivets. The arms and sliding head which operate the segments of the friction rim form toggle-jointed levers connecting the segments together, and the links and sliding collar connecting them with the shaft are also toggle-levers, making a double toggle-jointed mechanism adapted for thrusting out the friction brakes with great power.



BARTRON'S FRICTION CLUTCH.

This invention has been patented by Mr. Stockton Bartron, of Portland, Pa., who may be communicated with for further particulars.

SAFETY GAS BURNER.

The object of an invention patented by Mr. George W. Browne, of 195 Penn Street, Brooklyn, N. Y., is to avoid asphyxiation in case of blowing out, instead of turning off, the gas. In applying the invention to an ordinary gas burner, a kind of Bunsen attachment, B, is employed, to the upper end of the upper tube of which a coil of soft and spongy platinum, *d*, is applied; the platinum is thus held near the tip of the main burner. The lower tube of the attachment is tapped into the shank of the burner, and the shell is perforated at *b* to admit the necessary supply of air. The platinum is protected from displacement and from currents of air which might deflect the jet of gas issuing from the tube, *d*, by the shell, C, provided with openings to admit air, and also with an opening above the platinum. When the gas cock is fitted in the shank of the main gas burner, as shown in Fig. 1, it is grooved to admit a supply of gas to the attachment when the gas is turned on; when the cock is fitted in the service pipe, an opening is formed to admit gas to the attachment.

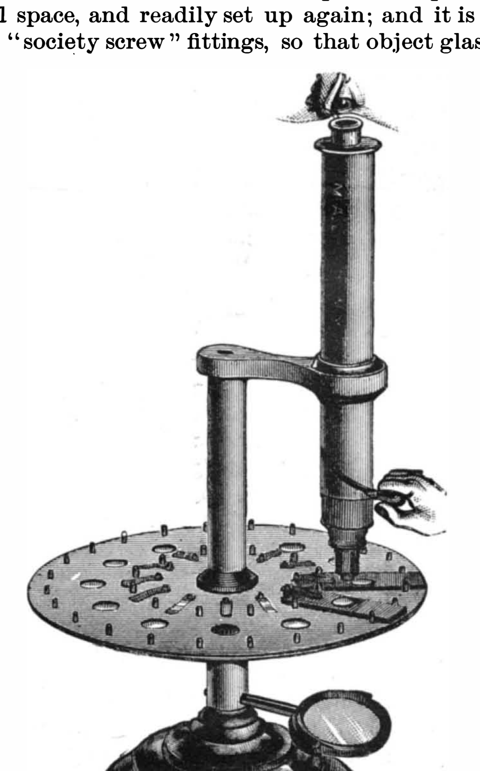
When the gas is lighted, the jet from the attachment burns and heats the platinum. Should the gas be blown out, instead of turned off, the jet of gas, *d*, would act to continue the heat in the platinum, which would increase, and in a short time reignite the gas from the attachment; this would instantly ignite the gas from the main burner.

Iron Straps in Carpentry.

T. Young, in the *Architect*, states that when it is necessary to employ iron straps for strengthening a joint, considerable attention is necessary that they may be placed properly. The first thing to be determined is the direction of the strain. We must then resolve this strain into a strain parallel to each piece, and another perpendicular to it. Then the strap which is to be made fast to any of the pieces must be so fixed that it shall resist in the direction parallel to the piece. Frequently this cannot be done, but we must come as near to it as we can. In such cases we must suppose that the assemblage yields a little to the pressures which act on it. We must examine what change of shape a small yielding would produce. We must now see how this would affect the iron strap which we have already supposed attached to the joint in some manner which we thought suitable. This settling will, perhaps, draw the pieces away from it, leaving it loose and unserviceable. This frequently happens to the plates which are put to secure the obtuse angle of butting timbers, when these bolts are at some distance from the angles, especially when these plates are laid on the inside of the angles. Or it may cause it to compress the pieces harder than before, in which case it is answering our intention. But it may be producing cross strains which may break them, or it may be crippling them. The strap which we observe most generally ill placed is that which connects the foot of the rafter with the beam. It only binds down the rafter, but does not act against its horizontal thrust. It should be placed further back on the beam, with a bolt through it, which will allow it to turn round. It should embrace the rafter almost horizontally near the foot, and should be notched square with the back of the rafter.

THE ILLUSTRATOR'S MICROSCOPE.

The accompanying illustration shows a most convenient way of mounting a microscope where it is desired to examine in succession a series of objects, either in the class-room, drawing-room, or laboratory. From a substantial metal base a central pillar rises, with an arm at the top carrying the microscope; the pillar also supports a revolving stage, 10 inches in diameter, a mirror beneath the stage illuminating transparent objects, and the total height, with a 10 inch microscope, being about 18 inches. The use of such a microscope stand allows of the arrangement of a series of slides, so that a number of objects can be examined without having to stop for adjustment and focusing for each. This instrument can be taken apart and packed in small space, and readily set up again; and it is made with "society screw" fittings, so that object glasses of



McALLISTER'S ILLUSTRATOR'S MICROSCOPE.

any standard maker can be attached to it. A patent has been applied for on this device by the inventor, Mr. T. H. McAllister, manufacturing optician, 49 Nassau Street, New York.

A LINIMENT of equal parts of oil of wintergreen and olive oil, or soap liniment, is said to afford almost instant relief from pain in acute rheumatism.

PHOTOGRAPHING THE LARYNX.

An endeavor has many times been made to photographically reproduce the image of the larynx that is given by the larnygoscope. It was in 1862 that I, for the first time, occupied myself with experiments of this nature, in company with my regretted colleague, Prof. Czermack, who was so prematurely torn away from his scientific researches. For obtaining photographs of the larynx, we at that epoch employed reflected solar light, and, as Prof. Czermack placed the camera at a distance of from three to six feet from the subject to be photographed, we obtained photographs of the larynx 0·08 of an inch in diameter.

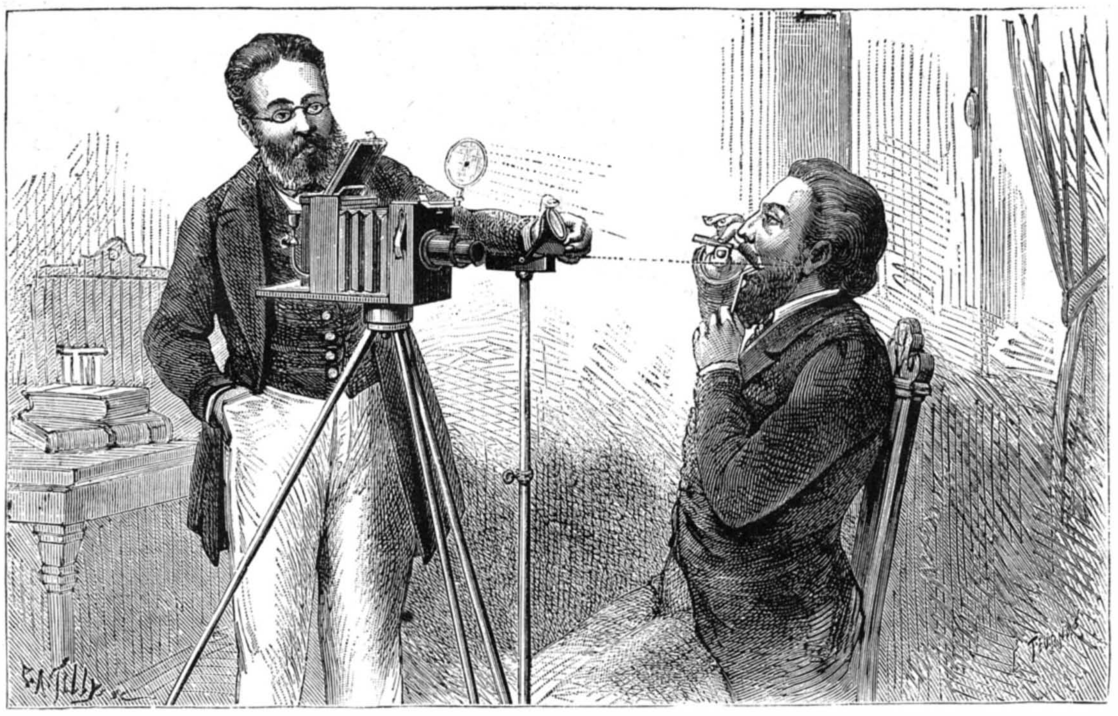


Fig. 1.—PHOTOGRAPHY OF THE LARYNX.

A long time afterward (in 1874), upon taking up the same subject again, I had recourse to the same light, but with a camera that had been especially constructed for the purpose (Fig. 1). The apparatus that I employed at that time are described in my treatise entitled "La Lumiere au Service de la Recherche Scientifique." Since then, various laryngologists have occupied themselves with the photographic reproduction of the larynx, and in the front rank of these must be mentioned Dr. T. R. French, of Brooklyn, N. Y., who, in *Laryngology* (October, 1883), has described a photographic laryngoscope that permitted him to come nearer to a solution of the problem, but one in which he still had recourse to reflected solar light. The principal improvements introduced by Dr. French consisted in connecting with the laryngoscope a small camera, but one which was still too large, and which he held in the hand, while he introduced into the patient's throat a large wire soldered to the objective and carrying the laryngoscope. A condenser threw the solar light upon a second concave reflector fixed in front of the operator, and from this mirror the luminous rays entered the throat.

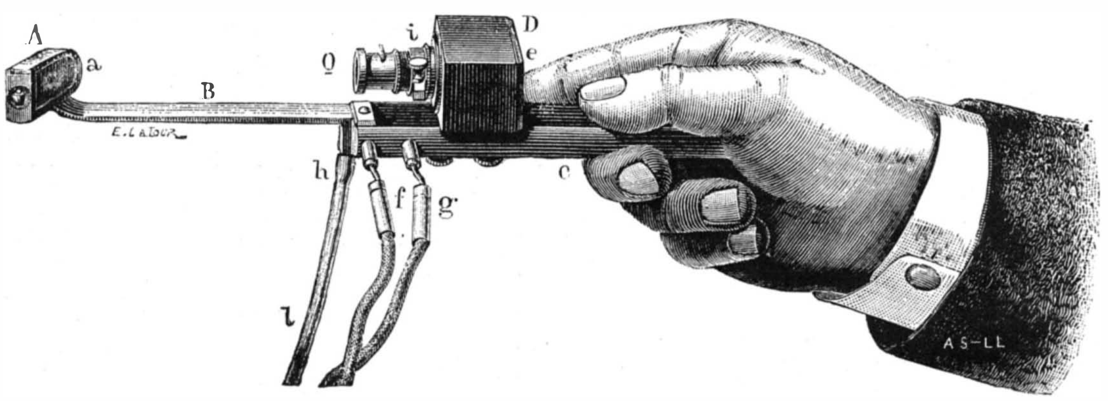


Fig. 2.—APPARATUS FOR PHOTOGRAPHING THE LARYNX.

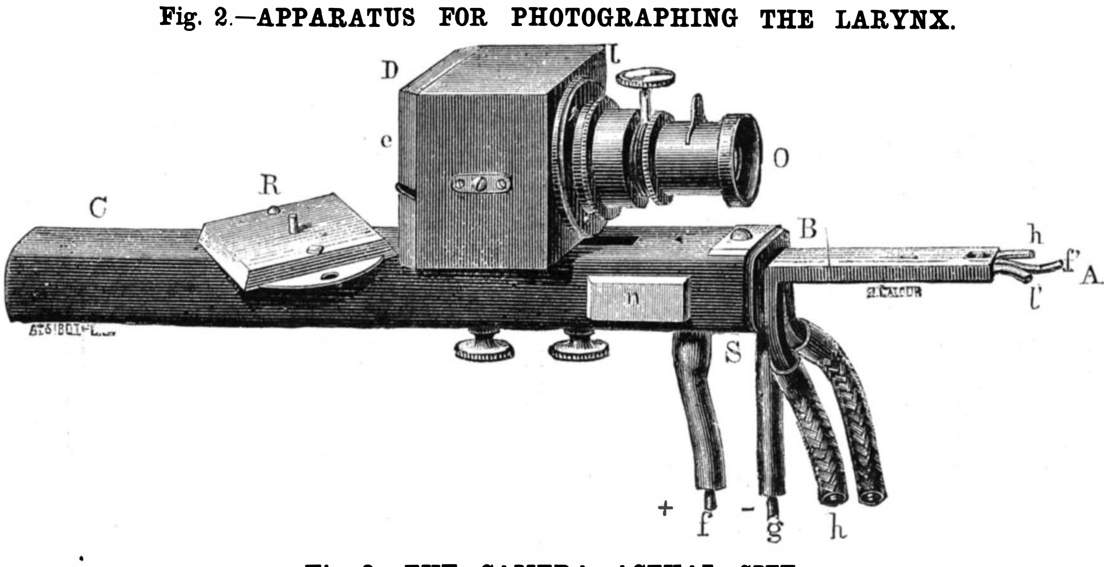
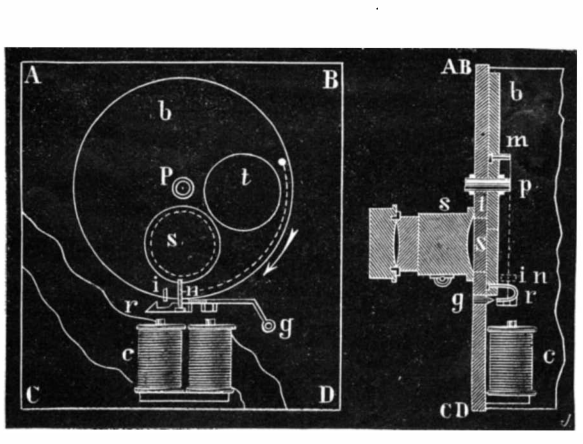


Fig. 3.—THE CAMERA—ACTUAL SIZE.

In recent times the arc electric light also has been employed for illuminating and photographing the larynx. The light, by means of powerful reflectors and condensers, is thrown into the throat of the subject, and, with an arrangement like that shown in Fig. 1, we succeed in getting photographic reproductions.

There appeared last year in England a publication entitled "Voice, Song, and Speech," by L. Brown and E. Behuke, which contains some very remarkable photographs of the larynx taken from nature. The apparatus used by the authors consisted of (1) a 10,000 candle electric lamp; (2) of a glass trough with parallel faces, through which were passed the concentrated rays of the electric light, and which was continuously traversed by a current of cold water designed to absorb the heat rays; (3) of a large condenser formed of plano-convex lenses; and (4) of a plane mirror that reflected the rays into the buccal cavity of the subject. For these reproductions it always took two physicians, two photographers, and one electrician. The results obtained were remarkable. But all such manipulation, which is tiresome to the highest degree, as well as costly, could be applied only in very rare cases. We meet here again another inconvenience: The source of light is not connected in an invariable manner with the laryngoscope, and so the rays that it emits are neither regular nor always intense in the same plane; and, on another hand, on account of the too great distance of the focus of the objective, the image of the larynx is always produced upon a relatively small scale, say about 0·06 inch in diameter.



Figs. 4 and 5.

The problem that I proposed to myself was, therefore, the following: To connect the camera, laryngoscope, and source of light, and give them as small dimensions as possible. In the apparatus shown in Fig. 2 I think that I have solved the problem. Here A, B, C is a laryngoscope constructed according to the principle of Nitze and provided with an electric lamp, *m*, and a circulation of water, *h l*, and the handle of which is connected with a camera, D. This latter is provided with a small objective, O, of 0·2 inch aperture and 1·6 inches focal distance. Exceedingly slight movements of the objective permit of fixing, once for all (for the same person), upon the ground glass, *e*, of the camera the image, *a*, of the larynx that is produced upon the mirror, A, of the laryngoscope. The small incandescent lamp projects its intense light upon the larynx. The light of this lamp (of from two to five candle power) exerts, according to the law of the square of the distance, a very energetic action, seeing that it is placed at about 2½ inches from the object that is to be photographed. A small, double box, R (Fig. 3), which contains two very sensitive gelatino-bromide plates, replaces the ground glass, *e*, after the focusing has been effected. Through the handle, S, of the laryngoscope runs a conducting wire, *f g*, which is interrupted in such a way that the circuit may be opened or closed at will by means of a button, *n*. In the interior of the camera, and at the front end, near *i*, there is arranged a disk that forms an electric shutter. This apparatus is represented upon a larger scale in Figs. 4 and 5. The disk, *b*, under the action of a spring, revolves around the central point, *p*, and is provided with a circular aperture at *t*. This piece passes rapidly in front of the internal aperture (shown at *s* by dotted lines) of the objective as soon as the armature, *r*, of the electro-magnet, *c*, is attracted. At this moment the finger, *i*, becomes free, and the disk revolves with great speed around its axis until *i* again engages with the armature, *r*, this taking place when the aperture has returned to its starting point. At the moment the aperture, *t*, is passing before the aperture, *s*, there occurs a short instant of exposure. If the light be too weak and the exposure must last longer, it is only necessary to press the button, *n*, for a longer time. This button sends the current not only into the lamp, but also into the electro, *c*, placed in a derived circuit (Figs. 4 and 5).

As long as the button, *n*, is pressed, *t* will remain opposite *s*, seeing that the finger, *m*, is always engaged with the projecting part of the armature at *n*.

As soon as the button, *a*, is pressed (Fig. 3), the electric circuit is closed, the lamp, *m*, is lighted, and, at the same instant, the electro-magnet (Fig. 4) opens the objective, so that a photograph of the larynx is taken automatically. If the light be intense enough, it will suffice to press the button, *a*, but an instant. If the gelatino-bromide plates are not sensitive enough, it will be necessary to press the button for a longer time. As, moreover, the electric light is produced only at the moment at which the circuit is closed, it is absolutely useless, when the work is being done in a dark room, to have recourse to a device for

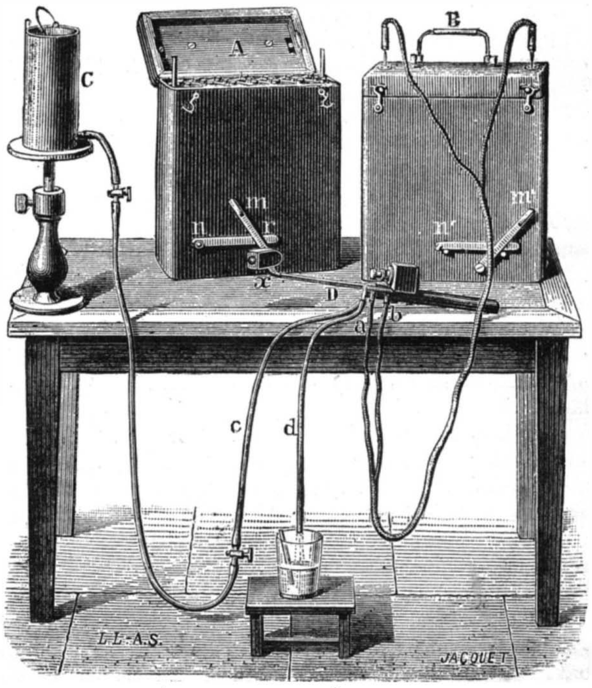


Fig. 6.—GENERAL VIEW OF THE APPARATUS.

closing the objective. In fact, as soon as the pressure at *n* ceases, the electric light is extinguished at *m*, and consequently the operation is interrupted.

Fig. 6 shows the general arrangement of the apparatus. A represents the small battery open; B, the same closed; and D, the laryngoscope; *a* and *b* are the conductors, and *c* and *d* the tubes through which the cold water circulates. This latter is derived from a small reservoir, C, placed a little above the apparatus, and circulates through the tubes during the whole time the operation is being performed. The small camera, which is shown of actual size in Fig. 3, is not represented in Fig. 6.

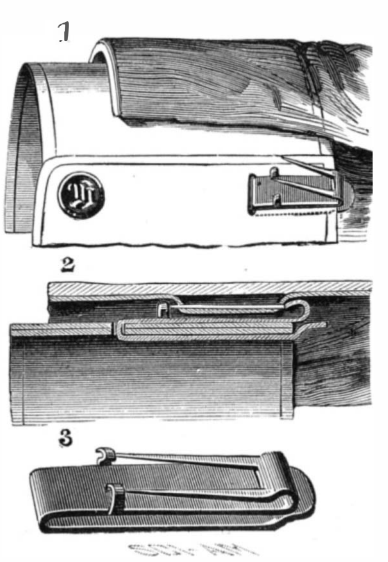
In the construction of this apparatus I am convinced that I have, in the simplest manner, and by electric processes, solved the problem of photographing the larynx, and that I have rendered a service to pathologic science. Many affections of the larynx, in fact, become modified from day to day, and it is of interest to have an apparatus that permits of following and controlling these pathologic modification, step by step.—*Theo. Stein, M.D., in La Lumiere Electrique.*

Construction of Observatories.

In the construction of buildings devoted to the purpose of astronomical observations, the most important requisite is to provide against the effects of vibration on the apparatus. Any contact with the floor or other portion of the building would not fail to produce, upon the slightest movement, concussions which, multiplied by the magnifying power, would render the telescopes useless. The mode of adapting the building for its peculiar use is by rendering it independent in all its parts of the piers upon which the instruments are fixed. The foundations of the latter are also laid as deep as possible, in order to obviate the effects of vibration from external causes, against which, however, it is not always practicable to guard, the mere tread of a foot passenger being often sensible to an observer using a powerful telescope at a considerable distance.

AN IMPROVED CUFF FASTENER.

This invention relates to a device essentially different from cuff fasteners heretofore introduced, for it is not intended to fasten the cuff to the shirt sleeve or band, but to the lining of the coat sleeve, so that when the coat is removed the cuffs remain attached to it, and they may always be adjusted to give the desired show beyond the end of the coat sleeves, regardless of the length of the shirt sleeves. The construction and application of the fastening will be readily understood by reference to the accompanying illustration, Fig. 1 showing it attached to the cuff, with the fastening pins ready to adjust on the coat sleeve, Fig. 2 showing the hold of the pins on the sleeve lining, and Fig. 3 the simple device itself, made of folded flat spring metal. This device, as will be seen, can easily be made to form a positive lock with the two rear button holes of the cuff, and the back or free end of the lower spring leaf is made to form a stop to prevent the cuff from slipping unduly backward after the fastener has been adjusted.



FAY'S CUFF FASTENER.

The above invention has been patented by Mr. James J. Fay, 42 North Sixth St., New Bedford, Mass.

The Armored War Ship Useless.

A French marine officer argues in the *Nouvelle Review* that the armor-clad ship is as completely obsolete as the old three-decker, and in any future war no iron-clad should venture to put to sea till all her opponent's torpedo boats had been destroyed. For this reason no more money should be spent on the construction or keeping up of armor-clad vessels, and even those in progress should be abandoned. The best type of boat is one almost invisible, and quicker than the largest sea-going vessels. France possesses several that have proved themselves very successful, but should have at least 400.

Those existing are registered at 46 tons, and carry coal for 1,000 miles at medium speed. In case of need they could steam 22 knots per hour, are armed with four torpedoes, and cost $35,000 each. Ten vessels somewhat larger are now being constructed. The best type of sea-going torpedo boat should be about 131 ft. long or less, and about 12 ft. wide; she should be manned by 15 to 18 men, should carry provisions for 12 to 15 days, and coal for 1,500 to 2,000 miles. She should be able to steam 22 to 25 miles an hour, and be armed with six or eight torpedoes and one machine gun. The cost would be from $60,000 to $75,000. As a great nation's fleet should not consist entirely of torpedo boats, however, a concession is made in favor of vessels auxiliary to them, but it will be the part of the torpedo boat in case of war to sweep all vessels of the enemy whatever from the surface of the ocean, both iron-clads, cruisers, transports, and merchant vessels, and this mission it will perform without let or hinderance. The fleets of transports, packed with troops, will fall an especially easy prey.

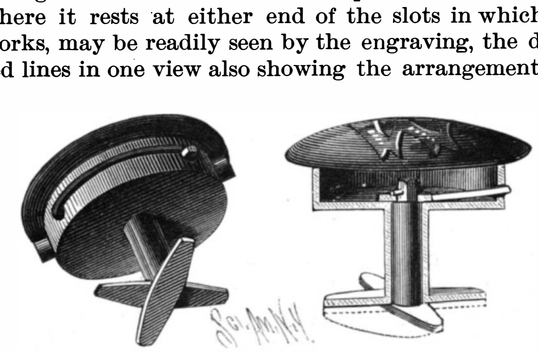
RIBBLE & SAMMIS' BABY CARRIAGE.

Modern Miracles.

People who suffer will fly to anything for remedy—even to patent pills, spiritualism, and pilgrimages. Referring to the methods resorted to for curing the crippled and sick, *The Graphic* (London) says that at Fecamp 150,000 quart bottles from a so-called holy spring are sold yearly; at Lourdes the retail business in water is twice as large, and the grotto is hung with the crutches of hundreds of people who are said to have come lame and to have gone away jumping. In some cases these cures have been quite genuine, for a strong nervous excitement will unquestionably do wonders. Not long ago, a man who was suddenly seized with delirium in one of the London hospitals leaped up, and began slashing at the patients in the beds all around him with a knife. One patient, who had been lying helpless for days under a stroke of paralysis, as it was believed, got so frightened that he recovered the use of his legs, and bounded down stairs with most gratifying agility. A man endowed with strong will power may exercise ascendency over weak willed folk, and cause them very rapidly to shake off a nervous disorder.

IMPROVED SLEEVE OR COLLAR BUTTON.

The illustration herewith shows a novel device for sleeve or collar button, which has been patented by Mr. Joseph Wall, of Greenville, Miss. (Lock Box 109.) From the cap is a tubular downwardly-projecting stem, with a crosspiece at its lower end; within this tubular stem is an inner stem, having also a cross-piece at its lower end, and at its upper end a spring arm that engages with a notched lower edge of the cap. The working of the spring arm in the side of the cap, with the notches where it rests at either end of the slots in which it works, may be readily seen by the engraving, the dot ted lines in one view also showing the arrangement of the cross-pieces before and after insertion, the device making a button which can be inserted easily and rapidly, and will be held securely in place.



WALL'S SLEEVE OR COLLAR BUTTON.

A WRITER from Fiji remarks that when flocks of terns and other sea fowl rest upon the sea in great numbers the water becomes smooth, and there is "not a ripple to disturb them." This is ascribed to oil emitted by the birds.

IMPROVEMENT IN RUNNING-PART OF BABY CARRIAGE.

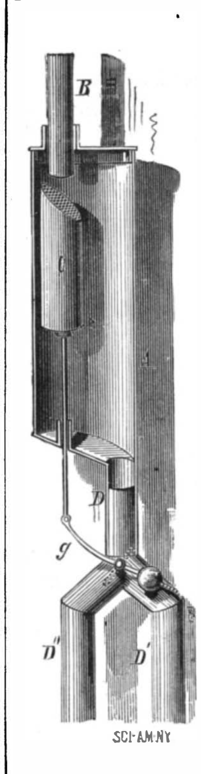
The great variety in which coaches for the little ones are now furnished shows that the makers have kept pace with that progress which has given us railway sleepers and palace cars. The illustration herewith shows a recently patented invention in this line, whereby the running gear is so arranged that the front wheels of the carriage may be turned to either the right or left, as desired, by the person who is guiding it from the rear. The device to effect this consists of a lever pivoted on the back handle, and extending by a right angle to a pivot in a loop hung from the rear axle, so that by slightly moving the hand on the handle the lever will cause the front axle to turn on its axis, to change the direction of the carriage, as represented in the illustration. This invention renders much easier the running of baby carriages, especially in the larger sizes, adapted for two children. The patent therefor has been issued to Messrs. H. M. Ribble and J. W. Sammis, and those who wish further information in relation thereto should communicate with Mr. Harry M. Ribble, P. O. Box 276, Dover, N. J.

The Biggest Gun Yet.

Preparations are making at Woolwich Arsenal for the proof trials of an enormous gun that is now in process of construction at Elswick, and will be delivered a few months hence. It will weigh 110 tons, and have a carriage of 90 tons, the total weight of 200 tons, being considerably in excess of previous undertakings. The gun will be a breech loader, and have a bore of 16 inches. Its length will be 43 feet 8 inches; but its extreme diameter at the breech will be only 5 feet 6 inches, and it will have a very elongated chase or barrel tapering down to 28 inches, with a slight swelling at the muzzle.

AUTOMATIC CUT-OFF FOR CISTERNS.

In the device herewith illustrated, which has been patented by Mr. John S. Heaton, of Shelbyville, Ky., provision is made for first using falling rainwater to wash off the roof and carry away dirt and impurities, after which the current is automatically turned to the cistern, the water not needing straining after the roof has been washed by the rain first coming down. In our engraving, A represents a sort of diminutive reservoir receptacle, considerably larger than the inlet pipe, B, from the roof; C is an upright cup, with slanting wire covered top, immediately under the inlet pipe. D is the outlet pipe, connecting with the waste pipe, D′, and the cistern pipe, D″. The water, striking the inclined top of the cup, C, on first entering, is largely diverted to pass through D′, taking with it the leaves and other foreign matter which may be carried along from the first washing of the roof; but when a certain quantity of water has entered the cup, the additional weight causes it to fall, reversing the valve connected by the arm, *g*, with the rod of the cup, and turning the stream into the cistern pipe D″. The weight on this valve should be always more than that of the cup empty, but it can be so adjusted as to pass off more or less water as desired through the waste pipe before turning the pure or clean water into the cistern. When the water ceases to enter the apparatus, the cup will gradually be drained of its contents, and raised by the action of the weight, when the automatic valve will again adjust itself to shut off the first coming water from the cistern, as at starting.



Division of Power.

The old time notion of one immense central engine to furnish power for an entire large establishment is getting out of date. The change is to independent engines for each department, so that one may be stopped for repairs, or from slackness of work, while another may be run without carrying the load of the connecting shafting and pulleys. This is true economy, for sometimes the requirements of a really large establishment may be met by the power of a small engine—perhaps twenty horse power—serving for an establishment that requires in its entirety not less than one hundred and fifty horse power. It is best, also, that the steam should be furnished by independent boilers, and not from one battery of central boilers. In short, the change demands, for convenience and economy, the existence of separate engine and boiler plant for each department, the whole to be connected if required.

Climate and Health.

Dr. Poore lately delivered a lecture on "Climate in its Relation to Health" at the Society of Arts. He began by alluding to the fact that the crew of the Eira enjoyed excellent health in the Arctic regions under conditions which, in this country, or still more in the tropical countries, would be considered most mal-hygienic. The reason probably was that in the Arctic regions putrefaction and allied changes were impossible, owing to the cold and dryness, and the diseases dependent on putrefaction were also impossible. Attention was drawn to the fact that most of the diseases which were fatal in tropical countries were connected with putrefaction and decay, and, as instances of this, malarious diseases, yellow fever, and cholera were brought forward.

Since putrefaction depended upon the access of minute organisms to the putrescible matter, and since these organisms were found in the atmosphere as well as in the soil and water, a study of the floating matter in the air became most important. The air has been systematically examined in Paris and Berlin, and especially at the Observatory of Montsouris in the former city. Among floating bodies in the air were to be found spores of fungi, pollen, grains of starch, alga, etc., besides mineral matters of great variety. Miquel, by means of cultivation experiments, had been at great pains to estimate the number of bacteria and allied micro-organisms in the air, and the result of his experiments has shown a striking connection between the density of population and the number of bacteria in the air.

Thus, in each cubic meter of air there were found at the following stations the bacteria in number as follows: In the high Alps the air was pure, absolutely free from bacteria; on the Lake of Thun, at an elevation of 560 meters, 0·8; near the hotel of Thun, 2·5; in a room of the hotel, 60; in the park at Montsouris, 760; and in the Rue de Rivoli, 5,500. The largest numbers found were in the hospitals, where each cubic meter of air contained as a minimum 5,500, and as a maximum 28,000. In order that bacteria and other microbes may flourish, a suitable soil is necessary. Raulin's experiments with *Aspergillus niger* were explained. Raulin found that he could grow a uniform amount of aspergillus on a given area of a liquid of definite composition. This liquid contained, among other things, one fifty-thousandth part of zinc, and if the zinc were omitted, the crop of aspergillus fell to one-tenth of the normal; and if one one-million-six-hundred-thousandth of nitrate of silver were added, the fungus would not grow at all. This showed the importance of mineral ingredients in the composition of the "soil," and this fact helped in some measure to explain why it was that people seldom had the same fever twice. The reason being that the first attack exhausted the blood of something which was necessary for the growth of the organism upon what the fever depended.

A New Engine of War.

A trial of dynamite shells, under the auspices of the Senate Military Committee, took place March 12, on the banks of the Potomac, about half way between Georgetown and the Chain Bridge, Washington. The District authorities refused to permit the trials within the corporation limits of Washington, on account of the destructive concussions which were among the results of the preliminary trial a few days before at the Navy Yard. Four shots were fired with six inch shells, carrying eleven pound bursting charges of nitro-gelatine, which contains about ninety-five per cent of pure nitroglycerine. The range was 1,000 yards, and the target was a perpendicular ledge of solid trap rock on the south bank of the river. The first shell struck near the eastern margin of the ledge and exploded by concussion, shattering the face of the rock for the radius of about thirty feet, and carrying away several tons of debris, which were hurled for hundreds of yards up and down the stream. The second shell struck nearly in the center of the ledge, exploding as before. It opened a cavity on the face of the ledge about twenty-five feet in diameter, and excavated a pit or crater about six feet deep. Some of the fragments of rock from this explosion were hurled half a mile, one piece, weighing nearly twelve pounds, being thrown clear across the canal, and lodging near a farm-house adjoining the Georgetown reservoir. The other shots were similar in their effects.

A large concourse of people assembled to view the trial, among whom, in addition to several officers of the army and navy, were the military and naval attaches of the German, French, and Italian legations, and the Russian Minister in person. The trial was regarded as a success in every respect, and as a conclusive proof of the destructive powers of the six inch shells. The next test in the series will be made in a few days with eight inch shells carrying thirty-five pound charges of nitro-gelatine. It is possible that, in view of the effects of the six inch shells carrying only eleven pound charges, the local authorities may refuse permission to fire thirty-five pound charges anywhere in the vicinity. If so the next trial will have to be made at Fortress Monroe or Sandy Hook. According to the *Herald's* correspondent, the members of the foreign legations present manifested great interest in the trial, particularly the Russian Minister and the German military attache, who took copious notes of the proceedings. Some of the military and naval experts present expressed the opinion that any one of the shells fired to-day would have completely wrecked any unarmored ship afloat, and seriously racked the strongest iron-clad. The safety of the system of firing seems to be assured by the two trials that have been made, the shell leaving the gun in every instance as safely as an ordinary powder charge shell could do.

Agricultural Machinery Abroad.

One year ago a circular was issued from the State Department, Washington, and sent to all the United States Consuls, requesting a statement from each relative to the mechanical and agricultural industries of the several countries in which they are located.

The circular stated that much of ultimate success in trade depended upon the proper initiatory efforts made to a clear understanding of the wants and requirements of the several countries. A report on agricultural machinery in the several districts represented by consuls has just appeared. We take from it a few extracts:

Bremen.—Mr. Gillcox, the Vice-Consul at Bremen, reports that wonderful advances have taken place during the past ten years in the manufacture of agricultural impiements in Germany and France and Sweden, but that Germany has excelled in this respect all other countries on the Continent. The general demands are for the cheaper finished goods of the class used in the United States thirty or forty years ago, and while the Germans are making great progress, it is a mistaken idea to think that they will buy our goods at the high prices they are sold for at home.

Russia.—The extraordinary cheapness of their own make of agricultural implements, the poverty of the people, and their near proximity to Germany, England, and Austria, give the latter countries great advantages which the United States does not possess. Moreover, the system of long credits which is universal throughout Russia would be a great bar to our trade, and be attended by great risk. The McCormick's and Johnstone's reapers and mowers have a fair sale in Southern and Central Russia. Owing to the tendency which prevails in this and the neighboring countries to imitate good imported articles, the Consul-General recommends that trade marks should be registered, and inventions patented, before the introduction of our machines.

South Russia.—Consul Paul, of Odessa, says that in that part of Russia, self-raking reapers, of both American and English make, are used to a considerable extent, and that the American reapers have the preference, and are driving the English reapers out of the field, and that American mowers and horse rakes are used extensively, but of the latter, many German imitations are being brought into the country.

Germany.—Vice-Consul-General Hogue, of Frankfort, reports that American machinery has been introduced only to a very limited extent, though such implements as hay and manure forks have been introduced to considerable of an extent, and give satisfaction. The plowmaking establishments in Southern Germany turn out from thirty to thirty-five different kinds of plows, to suit all kinds of land to be plowed. Imitations of several kinds of American plows are made in Berlin. The "American Eagle" plow is made there in exact accord with the original. The same authority says of hay rakes that the teeth are imported from the United States, and the other parts copied from the ordinary American rake. Mr. Hogue recommends a prominent exhibition of our wares at some central point, Frankfort probably being the best, believing, he says, that a market would be found for them, if our manufacturers should combine and establish such an exhibition. Mr. Hogue closes his report by admonishing persons to secure patents on their articles before their introduction into Germany, otherwise cheaper and inferior goods will be produced which will injure the reputation of the American article.

Consul-General Brewer, of Berlin, reports that there are a number of establishments in the latter city engaged in the manufacture of agricultural machinery, one of which (H. F. Eckert's) employs nine hundred men. He manufactures wagons, thrashing machines, clover mills, fanning mills, machinery for cutting and preparing beets for sugar making, stills for making whisky from potatoes, horse rakes and plows, the latter on a very large scale, some of which are exported. It was represented to Mr. Brewer that they were then filling an order for four hundred plows for South America, a field our manufacturers of agricultural implements, and other machinery, ought to occupy. Mr. Brewer refers to the wonderful genius of the German mechanic for imitating the works of others, and refers especially to the vast number of the Wheeler & Wilson, the Singer, and other sewing machines, of well known manufacture, which are exposed for sale in the stores of Berlin.

Bavaria.—Consul Harper, of Munich, does not think it an easy matter to introduce agricultural machinery into Bavaria by the usual methods employed, but recommends that a number of manufacturers of different lines of agricultural implements combine, and send out a reliable and efficient person to visit the principal towns of Germany, and exhibit the articles he has to sell. An exhibition is held about the 1st of October every year in Munich, which is largely attended by people from the surrounding country.

At these exhibitions machinery is shown in operation, and a collection of agricultural machines and implements are displayed. Mr. Harper thinks it would be advantageous to our manufacturers to attend these exhibitions with their implements.

Brandenburg and Pomerania.—Consul Kiefer, of Stettin, gives an interesting account of the products of this part of Germany and the customs of the people. Agricultural machinery is made in great quantity in a number of the large cities. He mentions one establishment in Mannheim, who sold more than ten thousand cutting and thrashing machines in a single year.

And regarding prices, he states that a three horse power steam thrashing machine with portable engine, and freight paid to any railroad station in Germany, can be had for 3,625 marks ($862). Large machines, such, for instance, as steam thrashing machines, are often bought in company by a number of persons; they are also rented by the hour to farmers of small means. It may not be known to some of our readers that it is the custom in Germany for women as well as the men to work in the fields. According to Consul Kiefer, it requires four men and eight women to work a steam thrashing machine successfully.

Saxony.—Mr. Dubois, Consul of Leipzig, says the most popular of the American machines which have been introduced into that country are the mowers, horse rakes, and hay forks. American machines they prefer to the Saxon make, for the reason that they are lighter, and they believe them to be constructed of better material. Mr. Dubois mentions a peculiarity of the Teuton in his fondness for the color of red; this color it is said predominates in the machine factories of Germany. But the first wish of the German farmer is to have his machine made of the best material. In small implements the farmer prefers solidity, which he concludes will insure durability.

Mr. Dubois thinks the inventive talents of the Germans are improving very rapidly, and cites a Saxon genius who has made forty inventions (almost as many as our Edison) during the past three years, seven-tenths of which have proved practicable and of value.

In a future number we shall give extracts from the consular reports of other countries, believing our machinery manufacturers are interested in what is going on abroad in the several industries in which they are concerned at home.

Sending Logs Down Nevada Mountains.

The *California Architect and Builder* gives the following graphic account of the mode adopted in Nevada for getting logs to market. A chute is laid from the river's brink, up the steep mountain to the railroad, and while we are telling it, the monster logs are rushing, thundering, flying, leaping, down the declivity. They come with the speed of a thunderbolt, and somewhat of its roar. A track of fire and smoke follows them—fire struck by their friction with the chute logs. They descend the seventeen hundred feet of the chute in fourteen seconds. In doing so they drop seven hundred feet perpendicularly. They strike the deep water with a report that can be heard a mile distant. Logs fired from a cannon could scarcely have a greater velocity than they have at the foot of the chute. The average velocity is over one hundred feet a second throughout the entire distance, and at the instant they leap from the mouth their speed must be fully two hundred feet per second. A sugar pine log sometimes weighs ten tons! What a missile! The water is dashed into the air like a grand plume of diamonds and rainbows, the feathery spray is hurled to the height of a hundred feet. It forms the grandest fountain ever beheld. The waters foam, and seethe, and dash against the shore. One log having spent its force by its mad plunge into the deep waters, has floated so as to be at right angles with the path of the descending monsters. The mouth of the chute is, perhaps, fifteen feet above the surface of the water. A huge log hurled from the chute cleaves the air and alights on the floating log. You know how a bullet glances, but can you imagine a saw log glancing? The end strikes with a heavy shock, but glides quickly past for a short distance; then a crash like the reverberation of artillery, the falling log springs, vertically, into the air, and with a curve like a rocket falls into the water, a long distance from the log it struck.

Plating Small Pieces with Brass.

Dip them in a solution of six grammes sulphate of copper and six grammes chloride of tin dissolved in one liter of water. Or dip them in a solution of nine and one-quarter grains sulphate of copper and nine and one-quarter grains chloride of tin dissolved in one and three-fourths pints water.

A Railway School.

The Baltimore and Ohio Railroad Company has taken a step toward the practical solution of the vexed apprenticeship question, the outcome of which will be watched with the greatest interest. The company has a business-like way of grappling with such subjects, and thus far its efforts—for instance, in establishing an insurance association for its employes—have been crowned with remarkable success. An order has been issued establishing a technological school at Mount Clare, Baltimore, "for the promotion of a higher course of instruction for the apprentices than that now pursued," with the view of affording the young men in its employ opportunities for obtaining a liberal technical education far superior to those enjoyed by the employes of other railroads. All apprentices are embraced under the following general designations, and graded into three classes: the first or junior class of apprentices, the second class or cadets, and the third or senior class of cadet officers. The company bears the expense of the education of the apprentices and cadets, and in consideration thereof expects the privilege of availing itself of their services, at fair salaries, for at least three years after their graduation. From the day of their admission to the school, the apprentices and cadets are to receive pay as follows: The apprentices, 70 cents per day in the first year, 80 cents in the second, 90 cents in the third, and $1 per day in the fourth year; the cadets $1 per day in the first year, $1.12½ in the second, and $1.25 per day in the third year; and cadet officers, $1.50 per day in the first year, $1.75 in the second, and $2 per day in the third year. In their appointment to the school, preference is to be given, other things being equal, to the sons of employes who have been killed or injured in the company's service; and free tuition is given to those only who are sons of employes having been in the service of the company for five consecutive years. They must pass a board of examiners as to proficiency in elementary studies and soundness of health, and are subject during the years of study to rigid discipline and frequent examinations. The exact scope of the school and the service for which its pupils are to be trained are not clearly defined; but it is evident from the long courses that the places to which they may aspire after their training are high indeed. We do not believe that any attempt is to be made to carry the standard up to that of our technical colleges, the evident object being to fill the gap that the virtual abolishment of the apprenticeship system has made. There are few companies, of course, whose operations are so extensive as to allow them to follow the lead of the Baltimore and Ohio Company, should it score the success that its prestige in such matters makes reasonably certain. Much, however, can be done by association of firms and individuals engaged in the same business in the same district.—*Engineering and Mining Journal.*

The New Washington.

Washington was laid out mathematically, to begin with. It was mapped on a grand plan; and strange to say, it has finally been realized. Its success results wholly from external causes. Left to itself, Washington would have sunk long ago in its primeval mud, and future generations would hardly have known that such a city had once stood there. It has no elements of independent commercial prosperity. A single act of Congress, trundling the capital to some other part of the Union, could sweep Washington into nonentity. It is a political and social center. It is the home of the government. This, and this only, has made it possible to make it what it now is—one of the finest cities in the Union. The original plan on which it was projected has needed little or no revision. There is not a crooked street in the city. The streets, marked in one direction by letters and in another by figures, run at right angles, while its twenty-one broad avenues, named after as many States in the Union, cross these squares diagonally, converging at various centers as the spokes of a wheel fit into a hub.

One of the most distinguishing features of the new Washington is literally a superficial one. It is the finest paved city on the continent. And this, for the reason that it is without heavy traffic to destroy its smoothly laid floor of concrete. It was in 1871, if I mistake not, that Pennsylvania Avenue, which had a few cobble stones stirred into its mud, like plums in a pudding, was finally paved with concrete from the Capitol to the White House. The concrete floor has extended itself in every direction, until now the capital is a vast national roller skating rink. It is, above all things, the paradise of bicyclists. We meet them on every square, speeding over the smooth, hard pavement with the most alluring ease. They are much used by messenger boys, who ride with their hands in their pockets, as if they were a part of the machine. The Herdic and the hansom cab have also invaded the national capital. So smooth and unbroken is the pavement that it is easier riding in a Herdic than in a street car. The middle of the street, being as hard and even as a floor, is so much better than the sidewalks, which are largely paved with brick, that pedestrians in the quieter by-streets often desert the sidewalks for the asphalt. The boy in New York or Boston who "cuts behind" a wagon finds it to his advantage to hold his feet up. But the Washington boy drops his feet upon the ground, holds them close together, and clinging to the strap of the tail board, is dragged along as if he were sliding on the ice. While this exercise polishes the pavement, it stimulates the local shoe trade.—*Rev. S. J. Barrows, in Christian Register.*

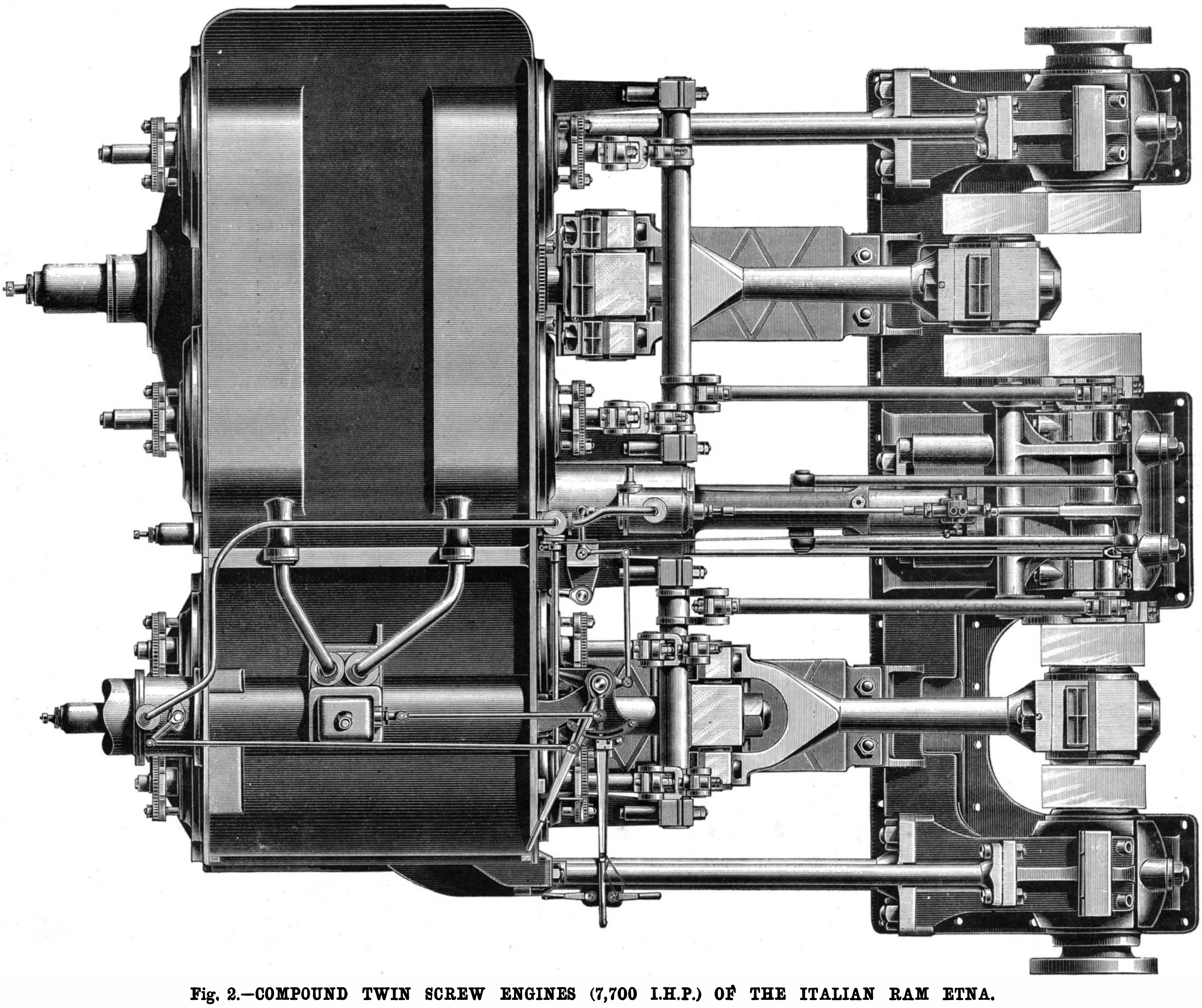


Fig. 2.—COMPOUND TWIN SCREW ENGINES (7,700 I.H.P.) OF THE ITALIAN RAM ETNA.

Caraway Seed.

A correspondent in *The Grocer* (London) estimates the product of caraway seed to reach 150,000 bales per annum. He adds: The chief centers of consumption are all the northern parts of Europe and the United States. Chief among all as consumers are the manufacturers of essential oil in Mid-Germany; one establishment of this description alone swallows up between 20,000 and 30,000 bales annually.

It may also be not known that the common Windsor soap owes its scent to the oil of caraway seed. Besides its employment as seed, the caraway fills a useful place in the general economy of husbandry by producing a fodder plant which is relished by cattle, and serves a great deal to sweeten less palatable food. In some parts of Germany it is to be found on every meadow along with other grasses.

Ichneumonidæ.

Dr. David W. Flora, of Newyago, Mich., sends us the following interesting particulars:

The SCIENTIFIC AMERICAN of January 31 contains an article on "The Mason Wasp," which brings to mind some observations made twenty years ago. On the half grown, wrinkled body of a "tomato worm" hung fifty or more little oblong pearl colored balls about the size of small rice grains. Placing the mass under observation, about three days thereafter a little lid or cap was raised from the larger end; out came a fiery, active, dark bluish-green fly. I was able readily to place it in the large family of *Hymenoptera*, and very soon saw enough of its habits to class it according to Cuvier as a member of the *Ichneumonidæ*. A few days after the advent of the little fly, I saw one alight upon the half grown body of a tomato worm, and in spite of its squirming, sputtering of green saliva, and striking out with that formidable "horn," our plucky little one kept on striking its stinger, or *ovipositor*, deep into the body of the worm, at every stroke depositing an egg. Some ten or twelve days thereafter there was an eruption all over the skin of "Mr. Worm." The surface seemed alive with little worms, which were larvæ of the ichneumon fly.

Instead of seeking some other spot in which to pass the "pupa" stage, it fastened a thread to a hair or spiracle of the "worm skin," and then and there proceeded to spin itself a cocoon. These threads were so fine that, when magnified 2,500 times they were not much larger than No. 30 sewing thread. Under the magnifier I saw the cocoon completed in about two hours and our larva retire from sight, to reappear after fourteen days as already described.

Baron Cuvier says: "They are so called from the Egyptian ichneumon, which was supposed to deposit its eggs in the entrails of the crocodile, which the larvæ afterward devoured.

"In Europe alone, there are more than 1,650 species of this family, and there are more than 6,000 species already known."

What a conservative influence this host of insects must exert upon the vegetable kingdom! Every species has many varieties, and this myriad host wages perpetual warfare upon the caterpillars and larvæ of the Lepidoptera generally.

This tiny insect cannot carry away bodily the great bulky tomato worm, nor even the smaller larvæ and spiders which the mason wasp does to feed its young, but it provides for its progeny by depositing the egg in the large succulent bodies of other insect larvæ, there to hatch and feed.

But so skillfully does the young ichneumon feed that neither the digestive nor ganglionic system of the victim is injured. Only the chyliferous vessels are sucked dry. Something like the fable of Prometheus, only the liver and vital organs are spared.

Our vast lumber interest is under obligation to the Ichneumonidæ. It seeks out by some subtle sense the location of the "wood borer," and with its long flexible ovipositor deposits its eggs in the body of that larva. I have seen it pierce the seasoned hickory wood nearly two inches to reach this matrix for its young.

From the description of the "mason wasp" given in the article referred to, and from my own study of its habits, I think it ought to be classed with the ichneumon family.

To make a "rope of sand" is conceded to be a feat impossible to accomplish, and the mud wasp in my opinion is not more likely to build its cell of sand, as stated in the article referred to. I have invariably seen them make their lump of the best, most tenacious blue yellow or other colored clay, of which they built their cell.

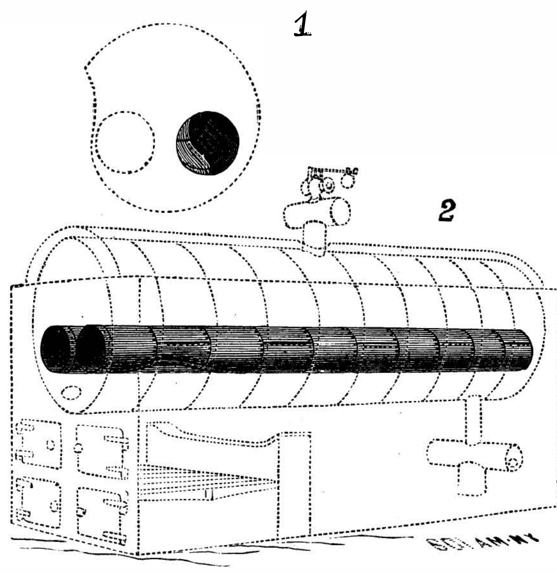
Red Ants.

The following by Prof. C. V. Riley will be of interest to housekeepers:

The small red ants are undoubtedly the most troublesome of the insects infesting houses, and to destroy them or even to keep them in check appears to be nearly a hopeless task, owing to the countless numbers of specimens and the remarkable persistency they exhibit in their attacks. All that can be done is to carry on an incessant and untiring warfare against them by means of liberal and frequent applications of pyrethrum powder, kerosene or kerosene emulsions, hot water, naphthaline, etc. Shallow dishes half filled with sweetened water and placed at suitable places will also attract multitudes of ants, which may be easily destroyed from time to time. Should the hole by which they enter the house be discovered (a matter of no small difficulty and sometimes even impossible), they can be more readily kept out by a good dose of kerosene poured across their path. A sponge saturated with sweetened water will soon teem with them, and if repeatedly cast into hot water when charged with the ants, will help materially to abate the nuisance.

A BOILER EXPLOSION AT CINCINNATI, OHIO.

The boiler at the Cincinnati Sheet Lead and Pipe Works recently exploded, doing no damage to the pro-



A BOILER EXPLOSION AT CINCINNATI, OHIO.

perty and causing no loss of life; it is somewhat of a curiosity, as a great many attribute the cause to shortness of water, the usual scapegoat in such cases.

The boiler is shown in Fig. 1 by dotted lines, except the flues, and part of the bottom, which were damaged. The appearance of the collapsed flue from the end is shown in Fig. 2.

The boiler was 42 inches in diameter and 26 feet long, with two 15 inch flues, and was made of ¼ inch plates.

The furnace was under the forward end of the boiler, the frame passing for 26 feet under the boiler and for 26 feet back through the flues, 52 feet in all; the right hand flue collapsed at the second or third ring from the front and upward; it also split along the under side of the longitudinal seam.

The theory of many was, at first sight, that the water became low and the flue then collapsed, of course by becoming overheated.

An examination into the whole conditions will show, I think, the true cause; the boiler was very old, and the flues according to modern practice very large; a defect occurred at the seam in the flue, gradually increasing till it so far weakened the sheet that it gave way along this seam, and the flue collapsed at this point, when, of course, the water went out (indeed, this may have been leaking out all night, the accident occurring at 10 A. M.); the boiler being empty, or nearly so, the bottom sheets would become heated and bulged, as shown.

If the boiler had been short of water, and the flues collapsed from that cause, it would have done so at the rear end of flue, and on the top, and also both flues would have been damaged.

This must, I think, be classed among accidents from a defective flue. A. R. P.

Indefinite Cost of Electric Lighting.

It has always been a difficult matter to get anything like a reliable estimate of the cost of electric lighting. The conditions of the problem vary according to the source of power, the number of lamps in use, the average time they are burned, etc., etc., so that electric lighting may prove to be economical in one mill or workshop, and more expensive than gas in another. Still it would be possible, no doubt, to ascertain the average cost of producing a certain amount of light under ordinary conditions, if the lighting companies were disposed to furnish the public with such information. That they do not want to do so was shown in the recent Electric Light Convention in Chicago. A committee had been appointed to ascertain the relative cost of producing the light by water power and steam power, but on second thought the Convention determined that it would be unwise to publish the figures. The committee was therefore discharged before any report was presented, and this for the avowed purpose, the *Phila. Ledger* thinks, of keeping the public in ignorance of the cost of electric lighting. It is doubtful whether such secrecy pays. It gives rise to the impression that the profits on present rates are enormous, and so encourages the formation of rival corporations.

PRACTICAL STUDIES OF MAN'S LOCOMOTION.

Our readers already know about the Paris Physiological Station,* and some of the experiments that have been performed there, and they have been enabled to see, by means of a series of instantaneous photographs, how we analyze the complicated mechanism of walking, running, and leaping, and how motions so rapid that the eye can scarcely seize them are fixed in a sort of diagram which faithfully reproduces their least details.

Such experiments, which are interesting to the physiologist, whom they permit to understand the mechanism of motion better and better, have, in addition, from a practical point of view, a utility that it will perhaps be not without interest to give prominence to.

Good walkers, good runners, and agile leapers are not only men who are endowed with special aptitudes, or who, by frequent exercise, have acquired muscular strength, but they are also *professionals*, that is to say, by the unconscious work that accompanies every frequently repeated act, they have gradually found a means of managing their forces so as to produce the best effect possible. Although every one has the pretension of knowing how to walk and run, there are, among walkers and runners, virtuosos after their kind, who exert no useless stress, and who regulate the rhythm and length of their step according as the stretch is to be a long one or the gait rapid. These professionals would be incapable of transmitting the secret of their skillfulness, since they know it not themselves, having scarcely reflected upon the acts which they perform, after a manner, mechanically. But this secret may be taken by surprise. For this purpose, I propose, as soon as fine weather sets in, to submit the motions of remarkable walkers and runners to photographic analysis. There is nothing rash in discounting the success of these future experiments, for the peculiarities of the improved gaits will certainly reveal themselves in the photographs. Finally, it is allowable to hope that, from the time when the characters of a correct gait shall be well known, it will become possible to teach the principles of walking, running, and leaping, and of all exercises of the body generally, in a methodical manner.

Fig. 1.—GENERAL ARRANGEMENT OF THE TRACK AND APPARATUS AT THE PARIS PHYSIOLOGICAL STATION

From a military standpoint, the question of man's walk is of peculiar importance, but presents likewise special difficulties. As the exercises of the soldier do not address themselves to men of polish, they must be regulated for individuals of medium strength. Experience alone must decide in such a matter, so it is after laborious researches that the length of the soldier's step has been fixed, as well as the rhythm of his walk and the load that he must carry, in order to utilize his forces in the best manner

* See SUPPLEMENT, Nos. 408 and 414.

possible. Nevertheless, if we consider that different nations do not have like customs in this respect, and that, moreover, the same nation modifies its military regulations from time to time, we must conclude therefrom that we do not as yet sufficiently know the physiological laws of man's work. This is why I have undertaken, with the aid of a few officers of rank, some experiments designed to perfect the ideas that I have in regard to the most favorable conditions connected with walking and running. The difficulty of such studies is due to the large number of observations that they necessitate, and to the unremitting attention and the almost superhuman patience that they require. So I have confided the tiresome business of registering the peculiarities of each individual observation to machines,

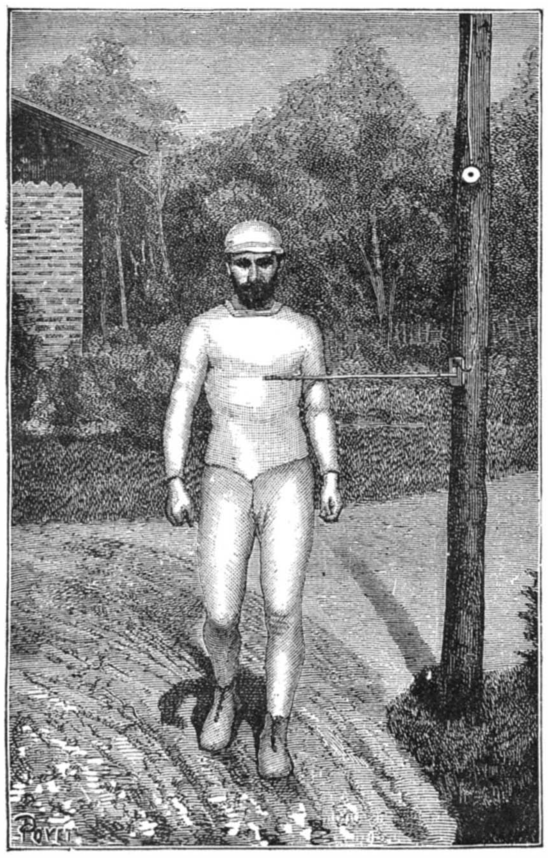


Fig. 2.—ARRANGEMENT OF THE INTERRUPTER.

leaving to the experimenter only the task of drawing general conclusions therefrom.

An apparatus which I described a few years ago, the *odograph*, after certain modifications in detail, has been found capable of inscribing the walk of man, and of faithfully translating the speed of his gait and its greater or less regularity, the number and length of his steps, and finally the modifications that the characters of the walk experience under different influences.

Fig. 1 shows a man running around the experimental track, and the apparatus that are inscribing the characters of his gait. Communication between the man, who is moving freely out of doors (upon a circular track about 1,600 feet in circumference), and the inscribing apparatus, which remains permanently upon a table in the laboratory, is established by a series of electric signals situated very near one another.

To this effect, a telegraph line, whose poles are spaced about 160 feet apart, runs all around the track. To

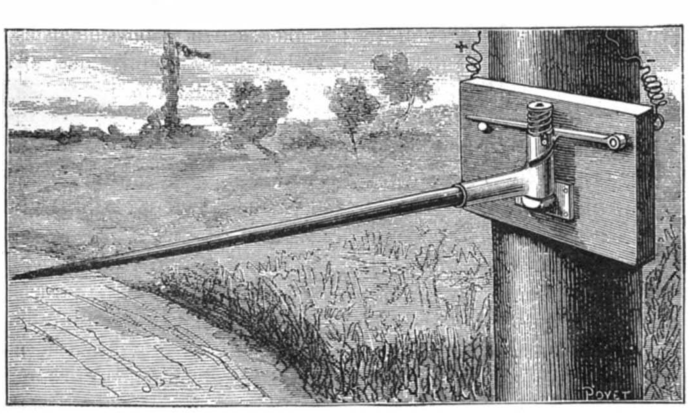


Fig. 3.—DETAILS OF AN INTERRUPTER.

each pole there is affixed an interrupting apparatus which sends a signal at the precise moment the man is passing the pole. The runner, in fact, finds his passage barred at these points by a horizontal rod (Fig. 2) which yields at the least pressure, but which cannot be deflected without producing an interruption in the circuit of the telegraph line. Now such interruption is translated by the movement of a pencil, which makes a mark upon a sheet of paper that covers a revolving cylinder. Each of such movements of the pencil shows that 160 feet have just been passed over by the runner. The mechanism of the electric interrupter is very simple. The rod is inserted into a copper tube, which revolves around a vertical axis and which is cut obliquely at its upper part, upon which rests a piece that moves vertically. This latter is beveled off beneath in a direction contrary to the bevel of the other. Every lateral motion given the rod will cause one of the beveled surfaces to slide upon the other, and lift the upper piece. It is this lifting that breaks the line circuit. To this effect, a horizontal spring that rests upon a metallic button establishes in front of each of the poles a contact that will be broken every time the movable piece lifts the spring. Such breakage will occur at every movement of the rod, whatever be the direction in which the man is moving upon the track. Immediately after the passage of the runner, the rod resumes its original position of itself through the action of the beveled surfaces that press upon each other. At the same time, the interrupted current is re-established. A new breakage will occur every time the runner, on passing a pole, comes into contact with one of the rods.

The current of a single element traverses the entire line, and, if we follow its passage in Fig. 1, we shall see it start from one pole of the pile, go to the top of the first pole, descend along it, traverse the contact which, in the interrupting apparatus, forms the spring that presses upon a metallic button, and then ascend to the top of the pole, whence it starts for the next pole, and so on. Starting from the last pole, it reaches the laboratory, traverses the electro-magnet of the odograph, and returns to the pile. As long as the current is closed, the electro-magnet, strongly attracted, throws into gear the clockwork which carries the pencil. At each breakage of the current, the wheelwork becomes free for an instant, and starts the pencil and causes it to move over the paper.

A few explanations will suffice to make the working of the odograph understood. The paper covered cylinder revolves uniformly under the influence of a clockwork movement placed at the extremity of its axis in a closed box. The velocity of its rotation is such that there passes in front of the pencil one-fifth of an inch of paper per minute. On another hand, the pencil (whose point, carried by a metallic arm, rests upon the upper part of the cylinder) is given a motion every time the line current is interrupted. To effect this, the carriage that carries the pencil parallel with the generatrix of the cylinder is traversed by a screw which a train of wheels contained in the clockwork box tends to revolve continuously. It is clear that the revolution of this screw will cause the carriage to move upon its rails and the pencil upon the paper. But the screw carries two lugs that hook on to the under side of the armature of the electro-magnet and prevent any movement of the screw. As soon as an interruption of the current occurs, the screw is set free and begins to revolve; but the passage of the walker in front of the interrupter takes but a moment, and the current soon closes and the soft iron is attracted anew, and when the screw has made a half turn, its second lug hooks on to the armature of the magnet. The pencil therefore moves forward at every breakage of the current a regular distance that corresponds to half the length of the screw's pitch, that is to say, four one-hundredths of an inch.

After a walk or run, the sheet of paper exhibits a sinuous line like that shown at *a* in Fig. 4. In this diagram the time is reckoned in a horizontal direction, in which the minutes are equivalent to two-fifths of an inch. The laps are counted in a vertical direction, in which each new ascent of the line corresponds to a movement of the pencil, that is to say, to a breakage of the current by the walker who is passing a pole. Every movement of the style, that is to say, every step of the sinuous line, *a*, therefore shows that the walker has made 160 feet progress. Thus, the line, *a*, of Fig. 4 corresponds to a walk in which 3,840 feet have been gone over in 15 m. 35 s.

Upon drawing a line that shall join all the salient angles of the zigzag line, *a*, we shall get a simpler expression of the walk; and this is what has been done with the lines, *b*, *c*, *d*, etc., which, through their greater or less inclination, show that the gait has been more or less rapid.

The more suddenly the line rises, the more rapid a gait it shows. Thus the curve *i*, the one that rises most suddenly, corresponds to a run in which 5,120 feet have been made in 9¼ minutes; the slowest gait corresponds to the curve *c*—a walk at the rate of 2,400 feet in 16 minutes.

In Fig. 4, we have been unable, because of its limited dimensions, to give anything but fragments of the tracings. The interest of this sort of an inscription consists, on the contrary, in collecting long tracings corresponding to several hours' walking. In this way we have a more faithful expression of the character of the gait, and may see therein the effect of excitement, which, in some men, quickens the walk during the first quarter hour, or that of fatigue, which, eventually, and in more or less marked manner, slackens it. With certain individuals the walk is wonderfully uniform, this being shown by the perfectly straight odographic tracing. Every irregularity in the speed, on the contrary, is shown by inflections of the line, which rises when the walk quickens and descends when it slackens. Such is the experimental arrangement employed at the physiological station for studying the different influences that modify the speed of walking, the influences of the load carried, of the form of the foot gear, of the rapidity of the rhythm of the clarion that regulates the step of soldiers, etc. These experiments are under way, and will not be finished in a long time, but they have already given quite interesting results.

We have just hinted that the form of the foot gear has an influence upon the speed of walking. In order to determine the best form of foot gear for walkers, I have had gaiters made of which the heel consists of plates two-fifths of an inch thick that may be superposed so as to give a height varying from two-fifths to two and two-fifths inches. In a series of experiments made with heels of decreasing height, I have always found that the speed of the gait increases in

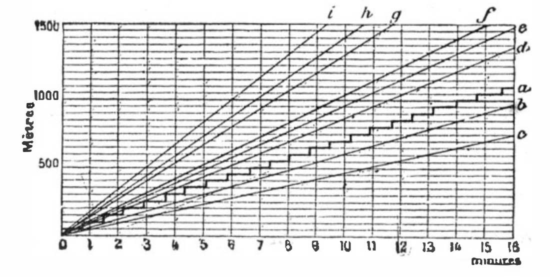


FIG. 4.—TRACINGS MADE BY THE ODOGRAPH.

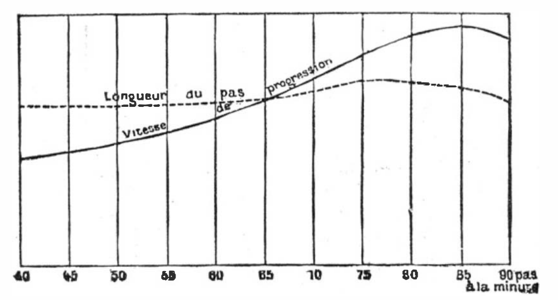


Fig. 5.—CURVES OF THE SPEED OF WALKING AND OF THE LENGTH OF STEP AS A FUNCTION OF THE RHYTHM OF THE GAIT.

measure as the height of the heel decreases. And this result is due to an increase in the length of the step. Upon substituting long, medium, and short soles for each other, I have found that the step is elongated and the gait becomes more rapid when the length of the sole perceptibly exceeds that of the foot. Above a certain limit, the precise determination of which cannot be made until after numerous experiments have been performed, the elongation of the sole is accompanied with a notable fatigue, and the walk is interfered with.

The rhythm of the drum or clarion regulates the soldier on a march, and, when it is desired that a body of troops shall quicken its step, the music is made more lively, and the number of steps taken in a given time becomes greater. But does it follow that the speed of the gait increases in the same proportion? We shall see that the problem is very complex, and that the acceleration of the rhythm of the walk increases the speed of the gait up to a certain rhythm bordering upon 80 steps to the minute. Beyond that the increase in the frequency of the step brings about a slowing up of the walk.

In order to determine such influence of the rhythm, it is necessary to add to the arrangement above described an apparatus that shall regulate with absolute accuracy the number of steps taken every minute. A pendulum, shown to the left in Fig. 1, at every oscillation interrupts the current of a powerful pile which actuates a bell located in the center of the track. This electric bell is placed upon a high wooden framework, so that it can be heard from all points of the track. It is impossible for the walker not to regulate his steps by the ringing of the bell, so that, at the end of any period whatever, the number of steps taken will be exactly that of the oscillations of the pendulum. Now, a slide running along the pendulum rod gives the latter a number of oscillations that is exactly determined beforehand for each of the positions. Upon giving the walk a slow rhythm of 40 steps to the minute, and then operating with more and more rapid ones, we find that the same number of feet is passed over in unequal times, according to the rhythm of the step.

Two celebrated German physiologists, the brothers Weber, have admitted that the steps became greater and greater in measure as their rhythm accelerates; but this formula is too general, as we shall see, and if it is true that, in a slow walk, the acceleration of the rhythm increases the length of the step, a greater acceleration finally shortens it.

But, it will be asked, how do you estimate the length of the step in such experiments? This length is simply deduced from the number of oscillations of the pendulum made during one turn around the track, which represents a perfectly well known distance. Now, experiment has shown that the progressive acceleration of the rhythm of the steps brings about modifications in their lengths that are expressed in the following table. Thus, an increase in the rhythm from 60 to 80 steps per minute has increased the length of the step; but, starting from the latter figure, the acceleration has produced an entirely contrary effect, it having diminished the step's length. The accompanying numerical table may be advantageously replaced by a graphic expression of the variations in the velocity of the gait and of the length of the step as a function of the frequency of the rhythm. Such a table is shown in Fig. 5. It is certainly more explicit than the three columns of figures from which it was constructed.

Time taken to travel 5,058 ft.	Number of double double steps per minute.	Length of double steps.
20′ 30″	60	4·43 feet.
18′ 40″	65	4·49 "
16′ 27″	70	4·75 "
14′ 38″	75	4·95 "
13′ 52″	80	4·92 "
13′ 3″	85	4·87 "
14′ 1″	90	4·34 "

The physical reason for this shortening of the step in very rapid rhythms has been determined, but to explain it would require details that would lengthen an article which is already too long. My only object on the present occasion has been to show how the precise methods of physiology may serve to improve the most ordinary acts of life.—*E. Marey in La Nature.*

Electricity Man's Slave.

BY THOMAS A. EDISON.

Among the many factors which have developed commerce and industry and stimulated all the forces of progress during the last half century, none has played a part so radical and essential as electricity. Hardly a single nerve or fiber of that complex body which we call society that has not thrilled and vibrated with its influence. It has strengthened the bonds of international amity; it has quickened all the methods of trade, and lent tenfold precision and celerity to the innumerable agencies by which it works; it has breathed new vitality into the arts and sciences; it has even warmed and strengthened the social forces; and, in a word, one may justly claim for it such a universal stimulus as cannot be credited to any other purely physical agency in the world's history.

It is not yet fifty years since the invention of the electro-magnetic telegraph, made by Prof. S. F. B. Morse, was first put into operation between Washington and Baltimore. To-day there is hardly a hamlet so small and so remote that a telegraph station does not link its inhabitants with every point of the civilized world. The crude apparatus first used by Professor Morse has been again and again improved on by subsequent inventors in the same field.

Only a few years elapsed after the success of Professor Morse before the first submarine cable operated in America was laid between Cape Ray and the shores of New Brunswick. This achievement in 1852 suggested to Mr. Cyrus W. Field, we believe, the connection of the New World with the Old, by means of a submarine cable. The history of the first Atlantic cable laid, the jubilee over its triumphant completion on August 6, 1857, its short life of less than a month, the pluck and energy displayed by capitalists in their endeavors to lay a second cable nine years later, the failure of this second effort, the ultimate success attained by the laying of the Anglo-American Telegraph Company's, and its final opening as a medium of public traffic on August 26, 1866—all these things are sufficiently well known to most of our readers.

Closely connected with the development of the telegraph came the invention of the speaking telephone, this being the logical consequence of the former. When it was once found possible to transmit signals over a length of wire by means of the electrical fluid, it was certain that sooner or later experiments would be made ultimately with a view to employing the same agent as a means of transmitting articulate speech to a long distance. These experiments reached a successful conclusion in 1876–77 by the nvention of the magneto receiving telephone by Professor Alexander Graham Bell, and the carbon transmitting telephone of the writer of this article. Many others have laid claim to the invention of the telephone, or to so-called improvements on the original devices. But so far the only instruments commercially successful are the Bell receiver and the Edison carbon transmitter, now universally accepted throughout the world.

Coincident with the development of the speaking telephone, the electric light was first brought to a practical success by the illumination of the Avenue de l'Opera in Paris by the Jablochkoff candle in 1878. Prior to this but little had been done in the way of electric illumination on an extended scale. The exhibition made in Paris gave a great impetus to lighting as a business. From that time to the present the progress has been marvelous and rapid, only second to that of the telephone.

Many inventors, among them Staite, King, Kossloff, Swan, and Sawyer, had previously been experimenting with a view to making useful lamps giving light by means of incandescence. But these experiments had been based on fallacious theories, and were foredoomed to failure. The writer was led to the invention of the filament lamp by keeping in mind the commercial necessities of the case as applied to a lamp forming but one unit of a complete system. His object, therefore, was not merely the device of an electric lamp; he aimed to invent a system of electrical illumination which could be operated on an extended scale in the same manner as in the business of gas illumination; to find some means by which electrical energy could be turned into light, and that light be used for household purposes and sold by meter record—in short, a system superior to that of gas and able to compete with it commercially. The final result of these experiments was the invention of a complete incandescent system, and the starting of a central station in New York at 3 P.M. on September 4, 1882. Then for the first time electricity for the production of light was supplied and sold on a meter. This station has been in operation since, night and day, and has been followed by the establishment of other stations, both in this country and in Europe.

In addition to the foregoing, electricity has been brought to the aid of metal workers for the purposes of electroplating and electrotyping; it has assumed a place in our houses for the operation of call-bells and annunciators, for protection against burglars, and for the correction of our clocks and other purposes.

Yet though so much has been already done in the last fifty years in the way of electrical development, the writer is confident that far greater progress will be made in the future. We stand to-day only on the threshold of its tremendous probabilities. The uses to which the electrical energy can be adapted are so numerous that the present generation hardly dreams of them. Nothing of any startling character can be expected of the electrical telegraph. The business has been so long established, the improvements are so numerous, that very little remains to be done. Some day there will be, no doubt, a sextuplex system, which will make one wire do the work of six. While none so far tried has succeeded commercially, the expanding magnitude of telegraphy makes it a necessity. This will enable the present telegraphic plant to do more work, and lessen the investment necessary for the installment of any future plant. The necessity for economic running expenses must lead to the use of a system of autographic telegraphy, which will enable the telegraph companies to dispense with most of their skilled labor.

The development of the telephone is in its very infancy. In the first instance, those in the center of cities alone had the advantage of telephone service; then the suburbs were reached, and later on towns adjacent. The service in cities is by no means satisfactory, and between cities and towns adjacent it is far more inefficient. The business has reached such magnitude that it has outgrown the present equipment. The company controlling the telephone business in this country fully recognizes this, and is working with all the talent which money and interest can obtain to improve the service. The result will be greatly to the advantage of the public, and consequently to the commercial development of the telephone.

The efforts made with a view to long distance telephoning have already proved quite satisfactory in a commercial way, and promise excellent results. Conversation has been conducted between Cleveland and New York, and is now daily carried on between New York and Boston to a limited extent. The great difficulty in long-distance telephoning is the loss of the current by static induction on the earth and wires in close proximity. If a single wire could be placed sufficiently high as to amply clear all the mountain tops, one could whisper around the world with perfect ease; or if a wire could be stretched from the earth to the moon, the connection would also be adequate. Perfect results were recently obtained on a government line in Arizona, a distance of about a thousand miles, the wire stretching over a treeless space of country, more perfect far than can now be had between New York and Hartford. The loss of the electrical energy by static absorption, and the running together of the electrical waves, is the fact that utterly precludes the possibility of submarine telephoning across the ocean. One thing, however, is now certain: that the time is close at hand when the telephone will be perfectly successful in an unbroken circuit for a distace of at least 300 miles; and that a subscriber will be able to communicate with 75,000 commercial houses. More than this, even, it is probable that by means of repeating stations communication can be had over all parts of the United States.

The changes wrought by the telegraph and telephone will be equaled, if not eclipsed, by the transformation wrought through electrical lighting. Two years' experience proves beyond a doubt that the electric light for household purposes can be produced and sold in competition with gas.

It is immaterial whether the electrical energy is used for light or for other purposes. It is so easy of control, the apparatus required so inexpensive, that it can be used as a motor power for purposes innumerable. In a house it can be utilized to drive miniature fans for cooling purposes, to operate a sewing machine, to pump water, to work a dumbwaiter or an elevator, and for a hundred other domestic uses which now require personal labor. In places where small steam engines are used at great expense, owing to the special attendance requisite, the electric motor will be invaluable. Electricity as a lighting agent has the great advantage over gas that it can be used at will for motor purposes, and that its operation for the latter purpose is as simple as for incandescence, which is done by the mere turning of a key like a gas cock. The function of electricity as a motor for household purposes will be hardly less useful than its value in illumination.

The great problem to be solved, however, by the physicist and electrician, before the art of electrical application attains its ultimate triumph, is the direct production of electrical energy from coal. The dream of certain French and German scientists that it may be transformed directly from the solar energy is a wild chimera, or at least it is remote and untrustworthy; but that it will be derived in some simple and inexpensive way directly from coal, which is solar heat and light stored up by nature, the writer believes to be a certain fact. The present methods of producing electricity are, at their best, very cumbersome and expensive. Expensive boilers, engines, and dynamo machines are the media through which the carbon of the coal is transmuted into electricity, and with enormous waste at that. A large amount of expensive labor, too, is needed, so that with the cost of the plant and of the labor to operate it, the ultimate product is very costly. Once, however, the secret of the direct production of the electrical energy from coal is discovered, a marvelous revolution will take place. The cost to the consumer will be very small. From one great central station in a city electricity will be furnished to give light, heat, and power to houses, stores, public buildings, factories, and workshops, and at so reduced a cost as to materially lessen the expenses of life and work. This is something more than a dream. It is a future fact which many now living will probably see realized. Such a direct transformation of coal into electricity would utilize 80 per cent; now by the process of turning the energy of carbon into heat, heat into energy of motion, and this into electrical energy, at least 90 per cent is lost.

Electricity as a motive power will not be confined to household or factory purposes. It has already been successfully used (for experimental purposes) at Berlin, Paris, Portrush (Ireland), and by the writer at Menlo Park as a motive power on a railroad. These various experiments have perfectly proved the practicability of the electric locomotive, and indicate that it will be largely adopted in the future in place of the steam locomotive.

Various experiments have been made with a view to the electric propulsion of carriages, cabs, drays, etc. The drawback has been that the power has been obtained from secondary or storage batteries, the depreciation in which is so rapid, and the weight of the receptacle so great, that until some radical improvements are made in connection with the storage of electricity, or the production of the same directly from coal, we cannot hope to see the subtle fluid used as a means of propelling street conveyances. Still daylight begins to shine on the problem, and the writer has no doubt that eventually most of our trucks and cabs will use this power. When this time comes, we shall find the scope of electricity vastly widened, and see carriages without horses, yachts without steam or sail, and many other novel adaptations. The problem of aerial navigation, too, will then be easily solved.

The vast deposits of rebellious ores, which for the want of an economical method of working are to-day practically useless, will probably at some date not far hence yield to man the precious metal they contain by assistance of electricity. Though the experiments have not been very successful, enough has been done to show that there will be eventual success.

Such, briefly told, are the marvels of electricity, as already accomplished, or as marked out on the sure lines of scientific foresight. If the story could have been told as a prophecy fifty years ago, it would have dazed even the most adventurous mind. Yet the other half of the story hidden behind the veil will not be a jot less wonderful. The writer, in reviewing what he believes from a long and absorbing study of the problems of electricity, has only touched on those phases of development which experiment has shown to be within the grasp of the scientific inventor. To discuss its possibilities would bring into play a line of speculation seemingly more akin to the dreams of the poet than to the sober judgment of the practical worker.—*N. Y. Tribune.*

To Make Watch Hands Red.

Mix to a paste over a lamp, one ounce of carmine, one ounce chloride of silver, and a half ounce tinner's japan. Put some of the paste on the hands, and lay them face upward on a sheet of copper, holding it over a spirit lamp until the desired color appears.

ENGINEERING INVENTIONS.

A fish plate fastening machine has been patented by Mr. Joseph H. N. Guilford, of Whigham, Ga. This invention covers a peculiar construction and arrangement of parts for a machine which can be readily clamped to either side of the rail, and affords a simple and convenient means of screwing up the nuts more rapidly and powerfully than can be done by hand.

A car coupling has been patented by Messrs. Clement Leidy and Charles E. Green, of Angus, Ohio. Combined with a drawhead having a sliding block is a downwardly swinging piece hinged on the block; a tripping pin is pivoted in a slot in the free end of the hinged part, and the lower end of this pin is connected by a link with the front end of the bottom of the drawhead.

A car coupling has been patented by Mr. John T. Sustaire, of Matthews, N. C. This invention covers a special construction to so hold a removable link on the drawbar of one car that it shall engage the drawbar of an approaching car without attention, and yet provide means so an attendant may guide the link with his hand in case it becomes necessary to couple with a car having a common drawbar.

A railroad tie has been patented by Messrs. Lee O. Vanderbilt and Milton E. Campany, of Muskegon, Mich. It is formed of two inverted bowls having plain upper surfaces, two fastening clips secured to the plain surface of each bowl by bolts, and a bar connecting the two bowls and secured by the fastening bolts of the inner clips; the concave side of the bowl is filled with earth well tamped or with concrete, the object being to furnish a tie which shall be practically indestructible.

AGRICULTURAL INVENTIONS.

A seed drill has been patented by Messrs. James J. Sweatt, George H. Sweatt, and Francis V. Sweatt, of Conyersville, Tenn. This invention consists of special combinations of parts and their construction in machines for planting seeds in drills, so they shall be simple in construction, convenient to use, and reliable in operation, planting the seeds regularly and in uniform quantities.

A combined hay and stock rack has been patented by Messrs. Jonas H. Hittle and Aurin D. Davis, of Mackinaw, Ill. This invention relates to racks adapted to be used on wagons for carrying hay, and also for penning hogs and other animals, and the patent covers improvements on a former patented invention of the same inventors, the construction of the rack having some new features which render it more convenient and reliable.

MISCELLANEOUS INVENTIONS.

A leather working machine has been patented by Mr. John A. Panton, of Quincy, Mass. This invention relates to improvements on the Holmes-Fitzhenry scouring machine, with the object of preventing the stones striking the table while the stock is being scoured, set, or worked.

A soldering pan has been patented by Mr. Thomas Leslie, of Brooklyn, N. Y. It is made with compartments to receive the resin, waste solder, wiping cloth, acid, and ammonia, and moulds for making the waste solder into bars, the pan being so constructed as to promote convenience and economize time.

A portable fire escape has been patented by Mr. Hermann Wettstein, of Harvard, Ill. It can be folded compactly to occupy small space, and is intended to be opened upon the ground so persons in burning buildings may jump upon it, it being of such size, strength, and elasticity that it will hold up without injuring those jumping from a great height.

A nut lock has been patented by Mr. Aaron C. Vaughan, of Shane's Crossing, Ohio. It is in the nature of a washer or thin plate acting somewhat after the manner of a jam nut, and so made that when turned up to the nut its inner peripheral edge binds the thread of the bolt with a friction that holds the plate and nut firmly against turning off.

A gate has been patented by Mr. Chas. L. Burden, of Gun City, Mo. The gate works by a loose hinging connection with cleats, so that expensive metallic hinges and fittings are dispensed with, and the gate works without the noise common to metal hinges, its construction being simple, the cost low, while the gate is a durable one for use on farms, etc.

An automatic stove damper has been patented by Mr. Daniel J. Dunn, of West Fitchburg, Mass. The damper is adapted to close by gravity to cut off the draught from a fire in a stove, heater, or furnace, and has fusible pins connected to its pivot, with a detent to act on the fusible pins to hold the damper open more or less, and to allow it to close when the pins melt.

A fork forming machine has been patented by Mr. Philippe DeneryDupont, of Summerville, Vt. This invention provides a mechanism for forming or shaping forks with suitably prepared blanks, the prongs being pressed and formed into shape at the same time without hammering, the same machine answering for different kinds and sizes of forks, so the work can be done better and quicker than by hand.

A fire escape ladder has been patented by Mr. Joseph Barnett, of New York city. It is made with a base frame provided with a turntable carrying standards and a hinged ladder, the standards and ladder being connected by a windlass, guide pulleys, and rope or chain, so the ladders can be easily raised for use and lowered for transportation, and be securely held when raised, and readily adjusted at different inclinations.

Improvements in the walls of buildings and other structures form the subject of a patent issued to Mr. William H. Orr, of Carlisle, Ind. The invention consists in building up such walls of hay, straw, or other loose, fibrous, balable material, and holding and compacting the bales together by bolts and plates, to give them sufficient hardness to admit of their being faced inside and out with cement or plaster.

A drum cover has been patented by Mr. George W. Brown, of New York city. It is made preferably of India rubber cloth, in the shape of a bag adapted to be drawn over the drum, and is more especially designed to protect the drum in stormy weather, there being a ring for holding the cover close to the drum head, so the cover will not interfere with the beating of the drum.

A coupling device for sand points in drive wells has been patented by Messrs. Charley F. Lang and Orlando C. Stafford, of Rising City, Neb. This invention covers a special device of coupling for use between a pump and sand point in driven wells, to allow the disconnection of the sand point from the pump, and save the time and labor required for withdrawing the sand points used in driving wells.

A lock has been patented by Messrs. Thomas Donahue, James Roche, Willard T. Goodwin, and William W. Cone, of Terryville, Conn. This invention consists in a mortise cabinet lock with a removable key guide, and an escutcheon plate in which the key guide is held, with various other novel parts and details, making a lock which automatically adjusts itself so the key can pass in without binding.

A lamp attachment has been patented by Messrs. Charles P. Bynon and James Stewart, Jr., of Yonkers, N. Y. It consists of a bar with a lip at one end for securing it to a lamp, and a burner support at its other end to be so attached to the lamp as to hold the burner, or burner and globe combined, and obviating the necessity of removing the burner and wick from the lamp while the lamp is being filled.

A darning attachment for sewing machines has been patented by Mr. Frederick W. Stewart, of Oswego, N. Y. This invention is an improvement in the class of stocking darning attachments for sewing machines in which a spiral spring and a sleeve encircling the needle are employed in connection with a ring that rests on the bed plate, and to which the stockings are secured.

A windmill has been patented by Mr. Joseph Benoit, of New Braunfels, Tex. The sectional spiral vanes of the windwheel have a flange on the outer edge, widest at the end of the vane on which the wind first takes effect, and inclined to the plane of the vane for deflecting the wind thereon, so as to more effectually hold the wind and be more effective, with other novel features of construction and arrangement.

An attachment for pants has been patented by Mr. John J. Neubert, of Rochester, N. Y. This invention provides an extensible band, with button holes, and held on the waist by elastic bands secured to the extensible band and to the seat of the pants, the attachment being more especially calculated for use on boys' pants, so the strain on buttons and button holes is materially decreased.

A die for fifth wheel heads has been patented by Mr. Nicholas Eccles, of Auburn, N. Y. This is a die of novel construction, to forge the members into form, after which the operation is completed by bending the forging, the head being formed square and the clip part twisted so as to lie flat on the axle, the object being to produce a strong and better head than can be made by the methods heretofore employed.

A breeching attachment for vehicles has been patented by Mr. John C. Williams, of Aurorahville, Wis. Instead of making the breeching strap as a part of the harness, it is, according to this invention, made separate from the harness, and the breeching is so connected to the thills of the vehicle as to make it adjustable backward and forward, and as to height, to accommodate the size of the draught animal.

A chimney cap has been patented by Mr. Theodore J. Steen, of Oakland, Neb. The cap has four upright corner bars, their lower ends tapered and bent outward, and their upper ends bent to fit against the under side of a peaked hood, to which the upper bent ends of the bars are riveted, making a chimney cap which is very effective, is held securely on the chimney, and can be fastened readily and easily.

A burial apparatus has been patented by Mr. Marshal Chastain, of Moulton, Iowa. It consists of a movable frame with a tilting earth box having a removable or hinged side, a windlass and operating ropes adapted to support the coffin, the apparatus to be used in opening and filling graves, for which it can be operated by a single person if required, and without scattering the loose fresh earth over the grass or lawn around the grave.

A portable dark room for photographers has been patented by Mr. William W. Walker, of Williamsport, Pa. It is formed of a flat box and a top to which two sides are hinged, the sides being adapted to be held in an upright position on the flat box when the dark room or box is erected, but when it is folded the top and sides are placed in the flat box sleeves are secured to the ends of the top and hinged sides, and plates of colored glass are held in the sides and top.

A gluing table has been patented by Messrs. James H. Clemons, of Dolgeville, and Joseph W. Bower, of Stratford, N. Y. It has a bed frame to receive the work, a clamp frame held above the bed frame and provided with one or more rods or bars carrying presser plates or washers, adapted to be swung to one side as each successive glued strip or piece is to be clamped to place, and means for pressing the plates to work.

A cherry pitting machine has been patented by Mr. James McVickar, of Caldwell, N. J. A circular table, centrally pivoted, has a series of apertures near its edge, a reciprocating arm so acting as to puncture the cherries and force the pits out of them and down through the openings, the machine being adapted for very rapid operation, while the pits are removed with less mutilation and waste than is usual in doing the work by hand.

An apparatus for rectifying spirits and spirituous liquors by electricity has been patented by Mr. Thomas E. Atkinson, of San Francisco, Cal. This invention consists of an electrode of hard wood with one or more carbon conductors perforated transversely with a number of holes, charred over its exterior surface and in the transverse holes, and having a covering of canvas provided with apertures corresponding with the holes in the electrode, so the electric current will precipitate impurities, and impart to the liquor the flavor of the wood of which the electrodes are made.

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 Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Minerals sent for examination should be distinctly marked or labeled.

(1) M. J. B.—The metric system is not the standard in the United States. You will not become a machinist by reading books. The best way to commence, aside from necessary shop practice, is to try and first learn something of mathematics.

(2) E. F. W.—SUPPLEMENT No. 160 will give you an idea of the construction of an induction coil such as you want, but the one there described would be too strong for ordinary med cal use. Make the secondary coil of about 10 or 12 layers of No. 28 wire instead of using No. 36. You should administer strong shocks with great care. They are sometimes dangerous.

(3) W. H. C. asks: What is the cheapest and simplest method of measuring resistances up to say 100 ohms? A. There is nothing cheaper than a rheostat and galvanometer. The "bridge" method is best, but a Wheatstone bridge is expensive.

(4) H. C. C. asks a simple recipe for preparing hop bitters.

A.	Hops	2	oz.
	Dandelion	2	"
	Gentian	2	"
	Chamomiles	2	"
	Stillingia	2	"
	Orange peel	2	"
	Alcohol	77	fl. oz.
	Water	77	" "
	Simple sirup	12	" "

Exhaust the drugs with the alcohol and water, and add the simple sirup. The cordial is a pleasant preparation, which is said to resemble the patented Hop Bitters.

(5) H. H. W.—Thunder is the sound resulting from an atmospheric electric discharge known as lightning. The duration of a flash of lightning is altogether too small to be determined by mere visual observation, though the sound is often prolonged for several seconds.

(6) G. F. J. writes: I have got a buggy that I keep in a barn where I have got three horses also. The varnish on the buggy becomes of a sulphur color. Can you tell me what does it? A. The ammonia arising from the decomposition of the animal refuse.

(7) J. V. S. asks: 1. Is the attraction of a magnet increased by the number of coils of wire that surround the magnet? A. Yes, up to a certain limit; but the current must be adapted to the winding to secure a maximum result. 2. How large are the largest magnets made in spool shape? A. We do not know that there is any fixed limit. Probably the largest in existence are in some of the large dynamos. 3. What can they be bought for apiece, and where can they be had? A. Any of our prominent dealers in electrical or philosophical instruments could supply you with a large electromagnet. 4. Where can I get reliable information in regard to the nature of electricity, with a view of applying it as a motive power? A. Purchase Du Moncel's Electric Motors.

(8) M. B. asks: What is the best thing to do with a seasoned round piece of hickory about 3 inches in diameter, 1 foot long, to make it keep its round, true shape year after year? A. Boil in linseed oil.

(9) D. F. L.—There is no patent process for welding copper. It is easily welded with a mixture of soda and ammonia phosphate, also with soda phosphate and borax. With a little care and experience.

(10) N. W.—There is no difficulty in laying the rails. You have only to allow for the expansion from the temperature at which they are laid and the heat of the rail under the sun on a hot summer's day, say 120°. You may easily measure the amount on any railway in your city. The rails require no slotting.

(11) W. C. writes: When the flame has passed under the boiler to back end, and returned through four inch tubes to front end, is there anything gained by still conveying the heat over the top of boiler to back end, when the chimney is at front? A. There is nothing gained unless the top of the boiler is kept perfectly clean. It has been demonstrated that the ashes that accumulate on the shell of the boiler are so light and porous that they only operate as a felting to keep the heat from descending to the shell. If the top can be kept clean, a slight superheating of the steam may be effected. The inconvenience of the arrangement is often more than the gain.

(12) E. L. M.—SUPPLEMENT No. 472 has a great number of receipts and formulas for perfumes. Your engine will run boat only about five miles, instead of fourteen miles, per hour.

(13) F. C.—For antique green: Dip in bath of 10 parts each sea salt, cream of tartar, and acetate of copper, 30 parts carbonate of soda, and 200 parts vinegar, until the required shade is obtained.

(14) R. O. D.—Rule for obtaining elevations by boiling water: Multiply 520 by the difference of the boiling point and 212°; to this sum add the square of the difference. For the correction for temperature add the temperature of the upper to the temperature of the lower station. For every 10° this sum is above 64°, add $\frac{1}{100}$ of the sum obtained above.

100° Fah. = 0·942 lb. per sq. ft.
175° " = 6·708 lb. per " "

You will find this tabulated on page 709, Haswell's Pocket Book, last edition.

(15) M. E. M.—The winter fogs are caused by a saturated surface stratum of the atmosphere under a falling temperature. They are of the same nature as clouds, and formed under similar conditions. In winter a cold wind or stratum of cold air settling over a stream on the land after a thaw or rain condenses the saturated moisture of the air on the surface, producing fog that lasts as long as the proper conditions continue.

(16) R. W. J. writes: 1. I have a frozen fire hydrant. How can I thaw it out without interfering with the valve or packing? Would alcohol thaw the ice? A. Salt is much used to liquefy ice, but there is nothing better in our opinion than a portable steam apparatus, a small upright boiler on legs or on wheels arranged to easily fill from a bucket through a funnel, with cock to close, and a connection for a small hose with a cock to check the steam, and also a small spring safety valve. This simple apparatus may be kept in the engine house ready to carry or wheel to any hydrant that may be frozen. It may be filled full of water, and a fire started before leaving the engine house. A boiler that will hold 4 pails of water should generate enough steam at 0 to 5 pounds pressure to thaw out any hydrant. To operate, pass the hose into the nozzle of the hydrant, and follow the thawed cavity down the pipe, or if possible pass the hose down the box outside the hydrant. Your style of hydrant will suggest the best way. These appliances are used here to good effect. 2. Is there a plumbing school in New York, and where could I get information relative to it? A. Yes, the New York "Trade Schools," First Avenue, 67th and 68th Streets, New York. 3. Are there any books published treating on the plumbing business? A. We know of no work on shop details in plumbing. On sanitary engineering there are many works.

(17) J. C. G.—The musical vibrations per second are, for E above the G clef 640, D 576, C 512, B 480, A 420, G 384, F 340, E below, 320. The whistling of the wind from a picket fence is caused by vibrations in the air, produced by interrupting its even flow, whether by pickets, trees, or telegraph wires. The Greely expedition reached farther north than Captain Nares did, Lieut. Lockwood attaining a latitude of 83° 24′. For article on the basin of the Gulf of Mexico see SCIENTIFIC AMERICAN SUPPLEMENT, No. 289; on the source of the Gulf Stream, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 95.

(18) M. J. W.—We do not know of any regular matrix paper for stereotype moulds except such as the stereotypers themselves build up with several sheets of tissue paper and flour paste. Some of the stereotypers on the New York morning papers use something besides paste to protect the moulds from burning, so that many plates can be taken from the same impression, and in this the workmen in the several offices each claim to have something a little better than their neighbors.

(19) S. L. G. writes: A kerosene lamp is broken on the floor, saturating the carpet and floor with oil. How can it best be removed? A. If the oil has recently been spilled, put on plenty of wheat flour or whiting to absorb the oil as much as possible. If the spot is near a seam, it is well to open the carpet and place the whiting underneath as well. Next day sweep up the flour above and beneath the carpet with a stiff brush, and put on plenty of fresh flour. If spots persist in remaining after this treatment, they can be removed by rubbing with flannel dipped in spirits of turpentine or benzine. Others use a preparation made by mixing a little soap into a gallon of soft, warm water, and then adding half an ounce of borax. Wash the part well with a clean cloth, and the spot will soon disappear.

(20) J. B. S. asks: 1. What is the pressure of one atmosphere per square inch? A. Generally taken as fifteen pounds. 2. What apparatus would you describe as the best one for proving that the greatest density of water is at 4° Centigrade? A. See description of apparatus given in Ganot's Physics. 3. What chemicals must a person use to freeze water by solution? A. See list of freezing mixtures given in answer to query 4 in SCIENTIFIC AMERICAN for June 21, 1884. 4. Can I make a Bunsen burner by cutting a hole in the gas pipe near the flame? A. Yes, if the other conditions are perfect. It is necessary to obtain the proper mixture of air with the gas to produce the burner.

(21) C. W. A. asks: 1. What power will be required to run the dynamo described in SUPPLEMENT, No. 161? A. One-quarter horse power. 2. How many Edison lights will it run? A. Two or three small ones. 3. If in order to get an intense current I wind the armature with very fine wire, will I have to change the wire on the field magnet? A. No. 4. Will cast iron do for the armature? A. Yes, if very soft.

(22) W. S. asks for one of the latest receipts for staining cherry a mahogany color. A. For dark mahogany: Introduce into a bottle 15 grains of alkanet root, 30 grains aloes, 30 grains powdered dragon's blood, and 500 grains 95 per cent alcohol, closing the mouth of the bottle with a piece of bladder, keeping it in a warm place for three or four days, with occasional shaking, then filtering the liquid. The wood is first mordanted with nitric acid, and when dry washed with the stain once or oftener, according to the desired shade; then the wood, being dried, is oiled and polished. For light mahogany: Same as dark mahogany, but the stain should be applied once. The veins of true mahogany may be imitated by the use of iron acetate skillfully applied.

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

B. B.—The specimen consists of chlorite with quartz; there is no evidence of gold on the specimen sent.

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March 3, 1885,

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TRADE MARKS.

Canned shelled fish, J. & E. A. Wyman........ 11,989
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Gloves, kid, C. T. Jones........ 11,984
Medicinal bitters, N. Kieffer........ 11,985
Medicine for the cure of toothache, W. W. Freeman *et al*........ 11,982
Shirts, collars, and cuffs, Holmes & Ide........ 11,983
Solution for the removal of corns, bunions, and warts, J. H. Myers........ 11,988
Wine of a dark-red color, J. Muench........ 11,987

A printed copy of the specification and drawing of any patent in the foregoing list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 361 Broadway, New York. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

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

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

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SUMMARY OF
FORTIETH ANNUAL REPORT
OF THE

New-York Life Insurance Co.

BUSINESS OF 1884.

REVENUE ACCOUNT.

Premium Receipts	$11,268,850.76
Interest Receipts	2,971,624.63
Total Income	$14,240,475.39

DISBURSEMENT ACCOUNT.

Paid Death-claims	$2,257,175.79
" Endowments	873,808.50
" Annuities, Dividends, and Surrender Values	3,603,970.85
Total Paid Policy-holders	$6,734,955.14
New Policies issued	17,463
New Insurance written	$61,484,550

CONDITION Jan. 1, 1885.

Cash Assets	$59,283,753.57
Surplus (Company's Standard)	$4,371,014.90
Surplus by State Standard (estimated)	$10,000,000
Policies in Force	78,047
Insurance in force	$229,382,586
Increase in Assets, 1884	$3,740,850.85

Death-claims paid		Income from interest	
1880,	$1,731,721	1880,	$2,317,889
1881,	2,013,203	1881,	2,432,654
1882,	1,955,292	1882,	2,798,018
1883,	2,263,092	1883,	2,712,863
1884,	2,257,175	1884,	2,971,624

Cash Assets.		Amount at risk.	
Jan. 1, 1881,	$43,183,934	Jan. 1, 1881,	$135,726,916
Jan. 1, 1882,	47,228,781	Jan. 1, 1882,	151,760,824
Jan. 1, 1883,	50,800,396	Jan. 1, 1883,	171,415,097
Jan. 1, 1884,	55,542,902	Jan. 1, 1884,	198,746,043
Jan. 1, 1885,	59,283,753	Jan. 1, 1885,	229,382,586

The Latest Advance in Life Insurance
IS THE
Non-Forfeiting Limited Tontine Policy
OF THE
NEW-YORK LIFE
Insurance Co.

A Policy combining the Non-forfeiture features, originated by the NEW YORK LIFE in 1860, with the Privileges and Profits of its popular "Tontine Investment Policy."

IT FURNISHES:

1. Term Insurance at low rates, with surplus accumulations at compound interest.
2. The privilege of continuing your insurance at original rates after your Tontine Period expires.
3. The entire Cash Value of your Policy in Ten, Fifteen, or Twenty years, on the basis of full legal reserve.
4. A grace of one month in payment of premiums, during which time your indemnity will be unimpaired.
5. Protection against loss, in case of default in payment of premium after three years, by the guarantee of a paid-up policy—as upon ordinary policies.

MORRIS FRANKLIN, President.
WILLIAM H. BEERS, Vice-President and Actuary.
HENRY TUCK, 2d Vice-President.
THEODORE M. BANTA, Cashier.
D. O'DELL, Superintendent of Agencies.
HENRY TUCK, M.D., A. HUNTINGTON, M.D., } Medical Directors.

H.W.JOHNS' ASBESTOS PISTON PACKING.

Our improved elastic Asbestos Piston Packing is composed of the best quality of pure Asbestos fiber, and forms the most perfect, compact, and durable Packing ever produced for locomotive, marine, and other engines, valve-stems, etc. It requires less oil than any other, being to a great extent self-lubricating, and wears ten times as long as ordinary packings. It is proof against acids.

Asbestos Wick Packing,
Asbestos Mill Board,
Asbestos Gaskets and Rings,
Asbestos and Rubber Tape and Cloth.

Asbestos Boiler Coverings.

Our ASBESTOS CEMENT FELTING is the most effective and durable NON-CONDUCTING COVERING for STEAM PIPES, BOILERS, STILLS, and other Steam-Heated Surfaces. It is composed of Asbestos fibre and a cementing compound, which forms a light, porous Covering, partaking of the nature of a Felt and a Cement. It can be easily applied by any one.

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Asbestos Air Chamber Covering,
Asbestos Locomotive Lagging,
Asbestos and Hair Woven Felt.

We also manufacture Asbestos Cloths, Asbestos Cord, Twine, Yarn, and Sewing Twine, Asbestos Sheathing, Asbestos Paper, Asbestos Gasket and Retort Cements, Sheathing Felts, Etc., also the Standard

ASBESTOS ROOFING
LIQUID PAINTS, PURE COLORS, ETC.
DESCRIPTIVE PRICE LIST AND SAMPLES FREE.

H. W. JOHNS M'F'G CO.,
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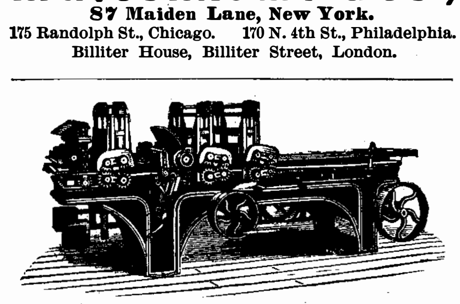
175 Randolph St., Chicago. 170 N. 4th St., Philadelphia.
Billiter House, Billiter Street, London.



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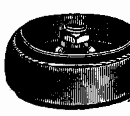
A collection of valuable Rules and Short-cuts for business calculations. It includes and fully explains the famous LIGHTNING METHOD OF ADDITION, and the Sliding Method of Multiplication, besides many other valuable contractions by which results are obtained rapidly and correctly. It commences where the text-book leaves off. Price $1, postpaid. THE WOODBURY CO., (P. O. Box 3608.) 105 Summer St., Boston, Mass.



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FOR ROLLER SKATES.

For use in dwellings, public halls, etc. Will not chip or injure common floors. Noiseless. Geo. P. Clark, (Box L.) Windsor Locks, Ct.

PATENT COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS, Limited,
Try Street, 2d and 3d Avenues, Pittsburg, Pa.
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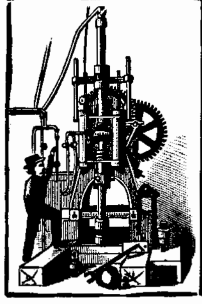
Geo. Place Machinery Agency, 121 Chambers St., N. Y.

PROSPECTING MINERAL LANDS A SPECIALTY.
CYLINDRICAL SECTIONS OR CORES OBTAINED THE WHOLE DISTANCE BORED.



ARTESIAN WELLS
BORED ROUND AND STRAIGHT ADMITTING A LARGER PUMP & CASING IN PROPORTION TO SIZE OF HOLE THAN BY ANY OTHER PROCESS. ESTIMATES GIVEN AND CONTRACTS MADE BY
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$9 ORGUINETTE FOR $5
WITH ROLL MUSIC.
MAMMOTH CATALOGUE OF MAGIC LANTERNS,
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THE CAMERON STEAM PUMP.

STANDARD OF EXCELLENCE.

30,000 IN USE.

MANUFACTURED SOLELY BY
The A. S. CAMERON STEAM PUMP WORKS, Foot East 23d St., New York.

KORTING UNIVERSAL INJECTOR
DOUBLE TUBE.

FOR BOILER FEEDING.
Operated by one handle.
WILL LIFT HOT WATER.
POSITIVE ACTION GUARANTEED UNDER ALL CONDITIONS.
NO ADJUSTMENT FOR VARYING STEAM PRESSURE.
WILL LIFT WATER 25 FEET. SEND FOR DESCRIPTIVE CIRCULAR.

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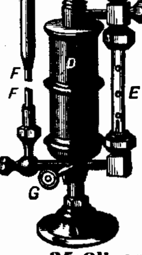
Standard Thermometers.

Accurate,
Legible.
SIZES OF DIALS, 5 and 8 INCHES.
FOR SALE BY
THE TRADE.
Manufactured and Warranted by the
STANDARD THERMOMETER CO.,
PEABODY, MASS.
General Agents,

FAIRBANKS' SCALE HOUSES

In all the principal cities of the United States and Canada.

The Seibert Cylinder Oil Cup Co.,



Manufacturers of Oil Cups for Locomotive, Marine, and Stationary Engine Cylinders, under the Seibert and Gates Patents, with Sight Feed.

TAKE NOTICE.

The "Sight Feed" is owned exclusively by this Company. See Judge Lowell's decision in the United States Circuit Court, District of Massachustts, Feb. 23, 82. All parties, except those duly licensed by us, are hereby notified to desist the use, manufacture, or sale of infringing Cups, as we shall vigorously pursue all infringers.

The Seibert Cylinder Oil Cup Co.
35 Oliver Street, Boston, Mass.

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THE AMERICAN BELL TELEPHONE COMPANY,

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Alexander Graham Bell's patent of March 7, 1876, owned by this company, covers every form of apparatus, including Microphones or Carbon Telephones, in which the voice of the speaker causes electric undulations corresponding to the words spoken, and which articulations produce similar articulate sounds at the receiver. The Commissioner of Patents and the U. S. Circuit Court have decided this to be the true meaning of his claim; the validity of the patent has been sustained in the Circuit on final hearing in a contested case, and many injunctions and final decrees have been obtained on them.

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(Descriptive catalogues forwarded on application.)

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Information furnished upon application.

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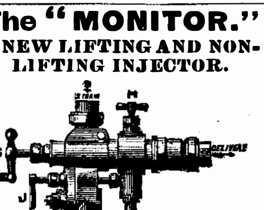
A NEW LIFTING AND NON-LIFTING INJECTOR.



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Greatest Range yet obtained. Does not Break under Sudden Changes of Steam Pressure.
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For Conveying Water and Liquid.
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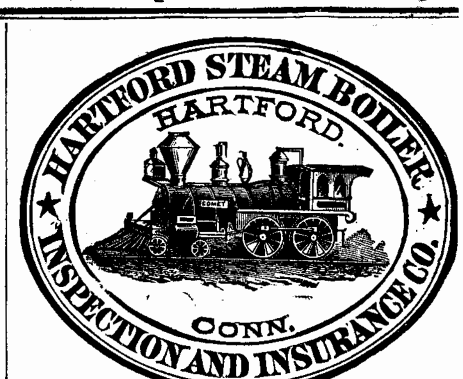

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