SCIENTIFIC AMERICAN

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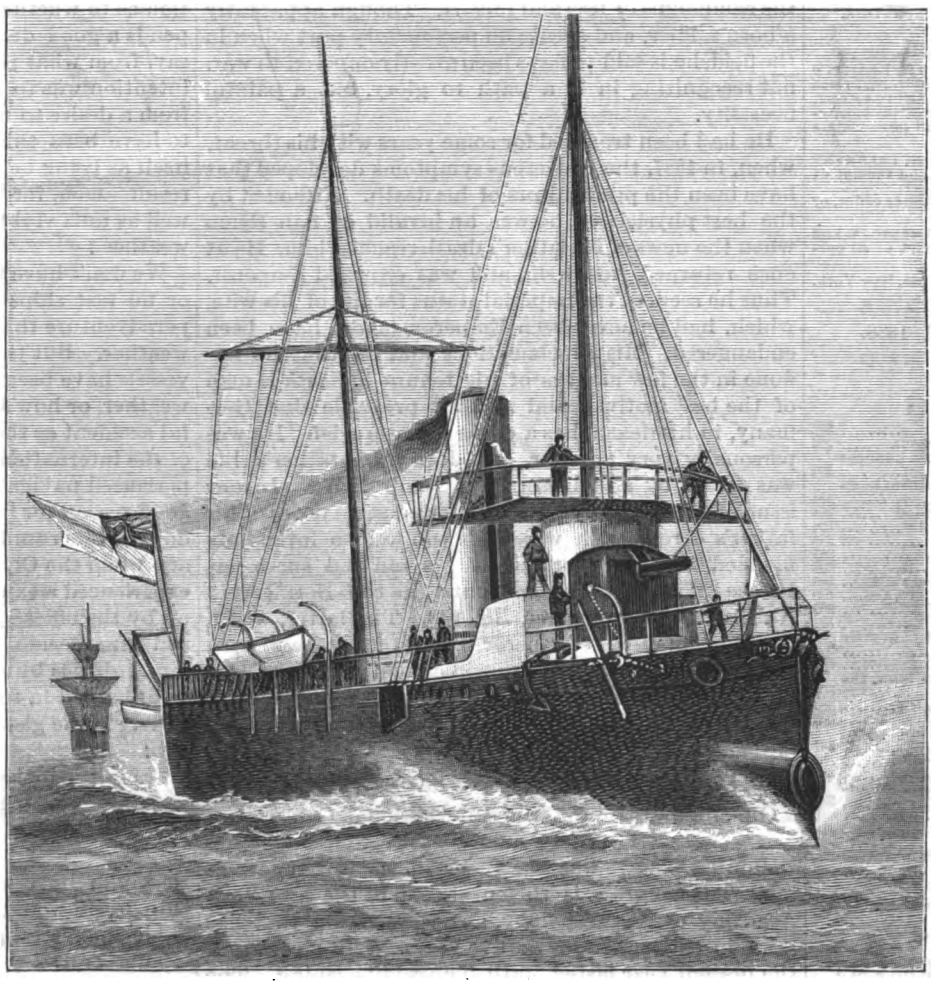
INSIDE AND OUTSIDE OF A TORPEDO VESSEL—H. M. S. RATTLESNAKE.

Torpedo gunboats and torpedo cruisers are the order of the day everywhere. It is now a long time since our naval authorities first came to the conclusion that, though we must be possessed of some big ships with heavy armament, both offensive and defensive, at the same time a large number of smaller light and swift craft were absolutely indispensable. Not a few critics of distinction have again and again urged that the larger vessels were too costly, and that a million sterling spent on one of these might be much more advantageously laid out on several second or third rate vessels of greater speed. Swiftness is everything as regards torpedo warfare. When one comes to think that a class of vessel of which the subject of the sketch is a type can be made to reach a speed of over twenty knots an hour, and that with a comparatively small consumption of fuel, the deduction must be that perfection has been almost attained. A score, or even a dozen, of these little vessels, under the cover of a dark night, would prove a deadly foe to grapple with. Armed with the "search light," they could make a dash on an enemy from different points simultaneously.

The Rattlesnake (twin screw steel torpedo gunboat, 450 tons, 2,700 horse power) is one of four in process of completion, the remaining three being named appropriately, as is the first, the Grasshopper, Spider, and Sandfly.

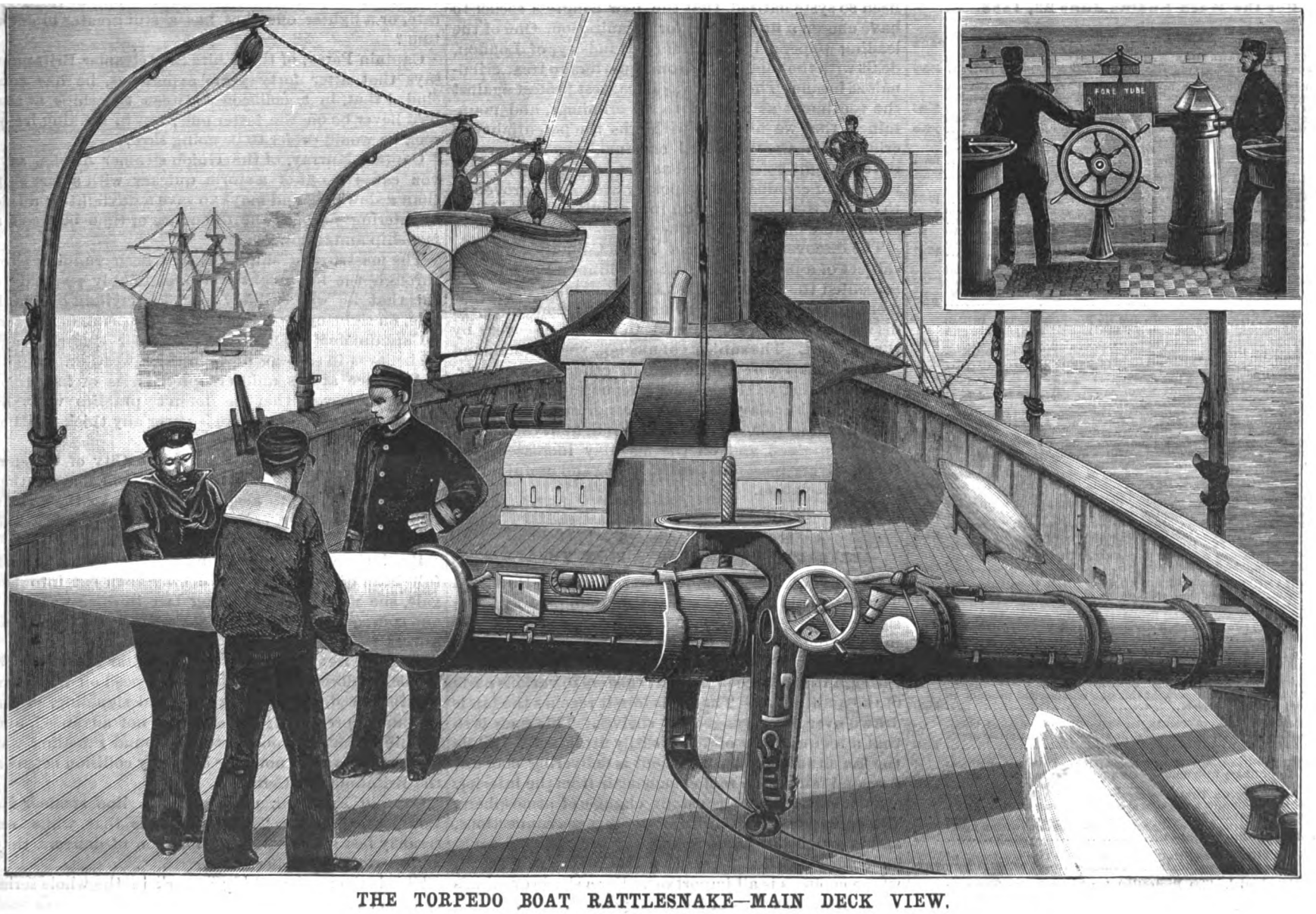
So pleased were the Admiralty with these boats, that they determined at once to augment the number by seven, thus making eleven in all; though the latter will be somewhat like the first named, they will be of greater tonnage, and, instead of carrying but one, will mount four guns. The Rattlesnake, though comparatively a little vessel, is constructed to "stow away" a marvelously large quantity of material in the shape of engines, coal, etc., and it is wonderful how sufficient space could have been found under the circumstances for cabin accommodation, yet there is just enough room, and no more. One may call her, indeed, a *multum in parvo*. Eighty tons of coal, her complement, will take her at the highest speed 1,500 miles, whereas the same quantity of fuel, at fifteen knots, will last over 2,500 miles.



THE RATTLESNAKE MAKING 23 MILES AN HOUR.

The "dynamo room" in the bow presents an interesting study, the space being very limited, and there may be truly said to be hardly "room enough to swing a cat." In this compartment, not only are torpedoes stored and fired, but the principal portion of the electric apparatus is also kept. The "conning tower" must not be passed over. It is there that the chief officers direct the movement of the ship, while taking sight of the enemy, by telegraphic communication to all parts of the vessel. Guns and torpedoes are also fired by wire from the same spot. The commander's cabin, in the stern, has likewise a very limited space, having room only for a bed, washing stand, and a sideboard, the remaining area being entirely taken up by the torpedo "gear." In the "mess room," Jack's life lies in a nutshell. The sketch gives only one-half the compartment, namely, that on the starboard side, looking "for'ard." At night time, when the hammocks are all slung and occupied, there is not a

(*Continued on page* 390.)



THE TORPEDO BOAT RATTLESNAKE—MAIN DECK VIEW.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 651,

For the Week Ending June 23, 1888.

Price 10 cents. For sale by all newsdealers.

THE EMPEROR OF GERMANY.

On June 15, the Emperor of Germany, Frederick III., passed away. On March 9, three months and six days before his own death, his father, William I., died, leaving his son and heir-apparent suffering with cancer, an incurable disease that threatened his death at any moment. He was born October 3, 1831, in the palace at Potsdam, a castle which was built by his ancestor, Frederick the Great. He was an only son of the Emperor William. His mother, the Empress Augusta, had been Princess of Saxe-Weimar. He visited England when but seven years old, and there made the acquaintance of Victoria and her family, among whom he met his future wife. In 1855 he was betrothed to the Princess Victoria, and three years later he married her. His return to the Continent with his bride was made the occasion of great rejoicings and ovations.

He served in the army with much distinction through the campaigns of 1866 and 1870–71. Though apparently a born soldier, and acting no perfunctory part when in the field, he is said to have been greatly opposed to war, not recognizing in it a path to glory, but a painful necessity.

He had been troubled for some years with his throat, when, in 1887, the cancerous symptoms developed that have been the premonitors of his death. Attended by the best physicians, he was an invalid at San Remo when the news of his father's death reached him. He at once returned to Berlin and was crowned Emperor. Thus he secured the imperial status for life of his wife, which, had he never been Emperor, might have been endangered. His proclamations and all that he has done in the few months of his tenure indicate a man of the best motives, and make it probable that Germany, in his death, has a cause for true grief. He was personally very popular, and during his father's life was called by all "Unser Fritz" (Our Fritz). In our issue of March 17, 1888, will be found some notes of his father's career, with which his son was so intimately blended, and the portrait of his son and successor, Prince William, will be found in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 643. The latter, whom we soon may see Emperor of Germany, was born January 27, 1859, and hence will ascend the throne at a comparatively early age, prepared for a long reign.

THE INTERNATIONAL CONGRESS OF ANTHROPOLOGY.

On Monday, June 4, the International Congress of Anthropology began to hold its first annual meeting. Columbia College was the scene of the initial gathering. The congress is the outgrowth of the New York Academy of Anthropology, an organization that has been in existence four or five years. The meeting of the present year lasted until Thursday evening. The science to which the association is devoted has of late years received such extension, and its methods have been so systematized, that the new congress seems to have chosen a fitting time for organization. One of the leading papers, by Dr. Henry Maudsley, of London, dealt with the tendency in some quarters to treat criminals as insane. The paper was an earnest protest against the sentiment as applied to all criminals, and maintained that we all have within us the potentiality of crime. Yet the "essential criminal," the author believed, might be considered as mentally defective. No theories of criminal anthropology are so well proved as to justify their introduction into criminal law. Allied topics were discussed by others.

The discovery of America before Columbus was the subject of a paper by Mr. James Phinney Baxter. He presented the latest grounds for the claim of the Norsemen to the discovery. Prince Roland Bonaparte, in discussing the paper, claimed an earlier discovery by the Chinese. The subjects of alcohol, vaccination, and general topics were considered in other papers. Mr. Geo. F. Kunz exhibited some remarkable jade carvings. On Thursday, June 7, the congress adjourned to meet again in 1892. The interest throughout the session was maintained, and on the last day increased, and there is every reason to predict a long and useful future to the association.

APPARATUS FOR COOLING AIR IN THEATERS.

An apparatus has been introduced in the Standard Theater, of this city, which in a very simple way is designed to solve the problem of securing a cool auditorium in summer. A fan is placed in the basement which draws air from outside the building and delivers it through the furnace pipes and registers to various parts of the auditorium. The air before it reaches the fan is drawn over ice arranged on shelves. This cools it so that a temperature of 70° is easily attainable. While the fan situated in the basement is delivering cool air, a second fan on the roof exhausts air from the interior, thus maintaining a constant change of atmosphere. The arrangement, in utilizing the furnace connections, and in general detail, is remarkably simple, and could be readily applied to many places, such as hospitals, where coolness is all important. For a single evening's work about two tons of ice are expended.

"ARE FAST OR SLOW STEAMERS THE SAFEST?"

In the current number of the *North American Review*, the masters of the Atlantic "greyhounds" respond over their signatures to the question: "Are fast or slow steamers the safest?" and, as might be expected of seamen, every one of them engaged in an attempt to shorten the voyage, devote themselves with unanimity to commending high speed. Like Samuel Weller in the now historical case of Bardell vs. Pickwick, they remember everything favorable to their own side, but are as obscure and uncertain as the fogs they are wont to race through as to the merits of the other. The nautical reader, especially, will regret that the coasters, both steam and sail, and the Banks fishermen were not invited to speak to the other side of the proposition, for, like the question, "Is fox hunting a healthful amusement?" in which the fox's opinion differs very materially from the huntsman's, the question as to whether fast or slow ships are the safest depends a good deal upon which you are on; that is to say, from what point of view you look upon it. If the intention was to inquire into the dangers which come from a desire to make quick trips—and it would seem to have been this—another form of question suggests itself as being better calculated to produce the required result—such, for instance, as this: Is it not unsafe as well as unlawful to run at full speed in foggy or thick weather?

We don't have to go to the mariner to learn whether or no fast ships are safe. The record shows beyond peradventure that they are, when they are run in clear weather. But the record doesn't say how many slow vessels have been run down by fast ones during thick weather, or how soon we may expect to hear of a dreadful accident as the direct result of the wanton violation of the international sailing directions. Surely the experienced navigators who framed these laws had some good reason for insisting that steam vessels should slow down while running through the fog. It is not so long ago when the Clyde Maritime Association, made up of experienced steamship builders, rejecting the claim set up by the officers of the Cunarder Oregon that she was run into, decided that, on the contrary, she got her fatal injuries by striking a sailing vessel while running at full speed in thick weather.

Here is the gist of what the masters of the fast boats say:

Captain Brooks, of the Guion steamer Arizona: "If you have a danger to encounter, the sooner you get over it the better; and if one steamer takes seven and another ten days to cross the Atlantic, it is evident that you have three more days of risk on the slow ship." He would run fast in the fog because the ship going the fastest gets the least injury.

This is all very well for the Arizona, but not so well for smaller vessels that may be in her track; and what is likely to be the consequence when she may happen to strike a ship of her own weight running at the same rate, or a lighter one that has a still greater momentum?

Captain Perry, of the White Star steamer Britannic, says that, after forty years' experience, he has concluded that, in a collision between two ships at sea, he'd liever be on the faster one; but in striking ice or rock he would prefer to be going slow.

Captain Murray, of the Guion steamer Alaska, says you can run out of a storm quicker with a fast ship than a slow one, and mayhap save a daylight or a tide in entering port by the difference of time between a fast ship and a slow one.

The master of a ship that had been running slow through the fog might very reasonably respond to this that he was as likely to strike daylight or a high tide, on sighting port, as if he'd been running faster.

Captain McMickan, of the Cunarder Umbria, says he believes in slowing down in thick weather.

A glance at his uninterrupted series of fast trips shows, however, that he doesn't practice what he preaches, or else that there is never any thick weather at sea when he's afloat.

Captain Lewis, of the Inman line City of Chester, says: "A steamer that goes nine knots in fine weather would find it hard to keep her head up to the gale in boisterous weather, especially if lightly loaded, and would be in danger of falling into the trough."

But if she were capable of making 18 knots, and with full head of steam on could only then eat into the gale, she would not be "going fast in thick weather," and consequently not be endangering human life so far as reckless speed was concerned.

Captain Kennedy, of the White Star steamer Germanic, deplores the fact that while speed on the ocean has increased, the science of sound signaling, so important in preventing collision, has not advanced, and he thinks that if a good system of sound signaling was in use, there would not have been any collision between the Britannic and Celtic.

Captain Frangeul, of the French line steamer La Bourgogne, says: "My opinion is that while extremely fast ships lessen the duration of dangers, they augment their number."

This is the most striking remark in the whole series of interviews, and it is obviously true.

Captain Land, of the Inman line City of Berlin, says a fast-going ship is safer in a fog than a slow-going one, because she can be turned quicker.

Perhaps a fair answer to this would be that if not going so fast, you'd have more time to turn in.

One captain complains that the Board of Trade (English) orders you to go slow in a fog, and the government (the post office) offers you a premium for making short passages.

Another, a clear-headed old mariner, declares with great truth that the question of fast or slow sailing resolves itself into a question of fogs.

MISCELLANEOUS NOTES.

The Senate of the United States has passed a bill for the purchase of three squares of ground near the Capitol, for the erection of a Supreme Court building. It will be a large and magnificent edifice.

An expedition for the exploration of the site of the ancient city of Babylon is now being organized under the auspices of the University of Pennsylvania. The staff of the explorers consists of the Rev. John P. Peters, of Philadelphia, for director; Dr. R. F. Harper, of Yale College, and Prof. E. Hilprecht, of the University of Pennsylvania, as assyriologists; Prof. John Henry Haines, photographer; and Mr. J. D. Prince, of Columbia College, as architect and physician. It is expected that they will begin work in the autumn, as no digging can be undertaken before November. This expedition is the result of a former effort in the same direction which was made in 1885, under the auspices of the American Archæological Institute, and for which the late Miss Catherine L. Wolfe gave the sum of $5,000. The subscribers to the fund of the present expedition embrace several well known citizens of Philadelphia, among whom are Messrs. Geo. W. Childs, H. C. Lea, H. H. Houston, Joseph B. Potts, Stewart Wood, W. W. Frazier, and C. C. Harrison. It is said the expedition will be very completely equipped, and the most interesting results may be expected.

The presidential address before the Alumni Association of Stevens Institute of Technology, on June 13, was delivered by Alfred R. Wolff, M.E. It contained many suggestions of interest. He thinks there might be advantageous changes from some of the studies which now occupy considerable time. Some abstract developments now dwelt upon at length, he thinks, might be advantageously omitted, while physical experiments and applications in heat, electricity, and the like might be more copiously introduced as exercises, both with the view of imparting a fair hold on the abstract taught and also as imparting requisite information and methods of procedure. "Better acquire some things thoroughly," he says, "than a greater number superficially, for only in a thorough acquirement can a correct and mature judgment be formed."

The statistics of the production of coal in the United States for the year 1887, prepared by Chas. A. Ashburner, have been issued by J. W. Powell, Director of the United States Geological Survey. From these statistics it appears the total production of coal was 123,965,255 short tons, valued at the mines at $173,530,996. Of the above, 39,506,255 tons were anthracite, valued at $79,365,244, the remainder being bituminous, brown, lignite, etc. It appears that coal is found in about 30 different States and 7 Territories. The little State of Rhode Island supplies 6,000 tons of coal.

Dr. Hobart Cheeseman, N. Y., states that the oxalate of cerium has been proved a remedy for cough in every stage of phthisis. He has had an extensive experience with the drug, and speaks of its utility in the highest terms. Dr. W. H. Gardner, surgeon in the United States army, recommends the oxalate of cerium in seasickness. He says: "I do not think I exaggerate when I state that it will cure or materially relieve 75 per cent of all cases." It is administered in doses of ten, fifteen, or twenty grains every two or three hours, in about one tablespoonful of water. He also says he has used it in hundreds of cases of sick headache with marked success. He also confirms Dr. Cheeseman's experience in regard to its useful effect in relieving cough.

Dr. Thomas Addis Emmett, of this city, describes his method of tracheotomy without the cannula. He uses a silver wire which is passed through the skin and the trachea, so adjusted as to turn the edges of the skin over into close contact with the edge of the opening in the trachea. He thinks it a comparatively easy matter to obtain an early union between the edges of the skin and the lining membrane of the trachea, and at the same time to preserve the necessary opening into the air passage. He thinks the cannula can never be so perfected that its presence in the trachea will avoid irritation.

A Reckenzaun electric boat has lately been constructed in Newark, N. J., and a successful trial trip from that place to New York recently took place. She is a trim little launch, 28 feet long, 6 feet beam, and 3 feet deep. Two long benches run fore and aft in her, back to back. Under them are storage batteries. The motors are aft under the deck. A trap door opens and reveals a 7 horse power motor for full speed and a 2 horse power motor for half speed. They are regulated by a handle convenient to the steersman, for whom there is a comfortable seat in the stern, and they drive a screw propeller. A handsome canopy covers the little boat, and from each of the eight posts hangs an electric lamp.

Gen. W. B. Franklin, of Connecticut, has been appointed by the President as Commissioner-General of the United States to the Paris exposition of 1889, and has accepted the office.

The Department of Labor.

The bill creating a National Department of Labor has become a law. The head of the department will be known as the Commissioner of Labor, and his salary will be $5,000 a year. He is to hold office for four years. The duties of the commissioner are to acquire and diffuse among the people of the United States information connected with labor in the most general and comprehensive sense of the word, and especially in relation to capital, the hours of labor, earnings of working men and women, and the means of promoting their material, social, intellectual, and moral prosperity. It is especially charged to ascertain, whenever industrial changes shall make it essential, the cost of producing articles at the time dutiable in the United States in leading countries where such articles are produced, under a classification showing the different elements of cost of such articles of production; to establish a system of reports by which, at intervals of not less than two years, he can tell the general condition, so far as production is concerned, of the leading industries of the country. He is also to investigate all controversies and disputes between employers and employes which may tend to interfere with the welfare of the people, and report thereon to Congress. The law virtually expands the present Bureau of Labor Statistics, which is a branch of the Interior Department, into a division of the government.

PHOTOGRAPHIC NOTES.

How to Ascertain the True Focus in a Lens.—One plan, described by Mr. Thomas Grubb, which we take from the *British Journal of Photography*, is as follows:

On the ground glass of the camera draw two vertical lines with a pencil, say one each an inch from the side, although this is not important, so long as both are of equal distance from the margin. Now place the camera on a large sheet of paper on a table facing a window and focus sharply any very distant object—a chimney or a tree—which is so placed as to cut one of the lines drawn.

Then run a pencil along the outer side of the baseboard of the camera, thus drawing a straight line on the paper underneath. Now rotate the camera as if the center of the lens tube was on a pivot, so as to have the object fall upon the line at the opposite margin of the ground glass, and draw a second line on the paper along the other outer side of the baseboard of the camera. Now remove the camera, and by means of a long, straight rule carry these two diagonal lines forward until they meet or intersect each other. Then where they diverge connect them together by a cross line equal in length to the distance apart of the two parallel lines on the ground glass screen. Draw a center line at right angles to the cross line, bisecting the angle formed by the intersection of the two side lines, and measure the distance from their intersection to the cross line, which represents the equivalent focus of that special lens.

Another method intended to find the precise focal center of a lens is described by Mr. Mathiot. First, a very distant object was accurately focused; then the position of the ground glass was marked on the base frame of the camera by drawing a line on it. Next an object was focused full size, and the position of the focusing frame was again marked.

By pushing in the camera bellows two marks are seen on the camera bed. Twice the distance between these two marks was then measured from the focusing surface and the distance marked upon the brass mounting. This last mark corresponded with the position of the focal center, or apex of the cone of emitted rays. This point, once fixed, serves as a basis for all subsequent operations.

Mr. Mathiot focused by measurement, not trusting his eyes.

Having found with his lens, to reproduce an object the same size, it should be distant 6 feet 5 inches, then to obtain an image one-eighth its full size it would have to be placed 11 feet 3 inches from the optical center of the lens. Thus different distances from the lens would produce proportionate images on the ground glass, always sharp and in focus.

Difficulty in Stripping Films from Paper.—It is claimed by James McGlashan that the insoluble sensitive film which is flowed over the soluble gelatine film renders the latter insoluble after a time, because of its absorption, by dampness and other causes, of a portion of the chrome alum in the sensitive film.

Paper recently coated, he found, stripped perfectly, but after it had stood seven or eight months, although kept in a dry place, it would not strip. Films should also be stripped from the paper immediately after development and fixing.—*Photo. News.*

John Jackson, in the *Br. Jour. of Photo.*, states that he has been able to strip the films, no matter how old, provided they have been kept dry. Immediately after development is finished, the negatives should be soaked for about one minute in a bath of weak hydrochloric acid, strength one drachm to twenty ounces of water, then well washed to clear them of acid before immersing in the hypo. bath. After fixing, the negatives should be rapidly washed in running water, or several changes of water, for half an hour, after which time they should be put down on the prepared glass and stripped after having been under pressure for twenty minutes. *On no account* should they be left soaking for a protracted time in water. If the stripping cannot be performed at once, the negatives ought to be taken out of the water and dried on sheets of vulcanite. When required to be stripped, which can be done at any future time, it is only necessary to soak them in an acid bath, as above given, wash the acid from them, and proceed to put them down on the glass, and strip as usual.

Orange Glass Substitute.—Mr. J. B. Huffman, of Chillicothe, Mo., sends the following substitute for orange glass for dark-room work to the St. Louis *Photographer*. It is simple and easily tried:

Asphaltum	3 parts.
Spirits of turpentine	1 part.

Coat the glass plate from one to four times, as desired, flowing the same as if it were collodion.

Preventing Halation.—In some kinds of gelatine plates, especially those coated with a thin emulsion, it frequently happens that a certain amount of disagreeable halation or fogginess is observed, where, for instance in a landscape view, the dark limbs of trees appear against a bright sky, or when an interior is taken with windows facing the lens.

Mr. A. A. Pearson, in a communication to the Leeds Photographic Society, which is reported in the *Br. Jour. of Photo.*, speaks of a remedy as follows: It is necessary to cover the back of the sensitive plate with a substance that will reflect non-actinic light. He prefers the old fashioned burnt sienna, as the rays it reflects are orange and non-actinic. This pigment can be obtained at a paint store ground in water to an impalpable paste free from grit, and it is only necessary to thin it with a little strong dextrine solution and glycerine with a drop of liquefied carbonic acid or oil of cloves to preserve it.

The sensitive plates are brushed over the back with it, put into an ordinary drying rack with films facing each other, and a large space between the wet backs, and stood on a metal plate which has been heated, and carried into the dark-room. They will dry in half an hour. In developing, the halation will be still further reduced and even cured by taking the plate out of the dish as soon as the windows appear (supposing it to be an interior) and carefully painting them with a fifty or sixty grain solution of bromide of ammonium or potassium, then returning it to the dish. He preferred to do it with a camel's hair brush.

Combining Developing Material with Sensitive Plates.—According to M. Vidal, plates are being made in Belgium prepared with a coating on the back which contains the proper amount of pyro. and alkali in a dry state to develop it. It also acts as a preventive of halation. After exposure in the camera the sensitive plate is placed in a tray of water. Soon the backing is dissolved, and, mixing with the water, forms the developer of proper strength for bringing out the picture.

M. Vidal suggests that a more simple plan would be to prepare sheets of paper in this way. After the plate was immersed in the tray the sheet of paper could then be plunged in over it, and as its salts impregnated the water the image would be gradually brought out. If it developed too fast, the sheet of paper could be taken out. Some such simple plan would be quite convenient to the traveling photographer.

An excellent way is to have the dry salts measured out and put up in small homeopathic bottles. To form the developer, simply dissolve in the requisite amount of water.

Mr. Edison's Baby and His Phonograph.

According to the New York *Herald*, Thomas A. Edison, the inventor, has been interesting himself with his new baby and a phonograph at his home. When the baby crowed with glee, the crow was registered on the phonograph; when it got mad and yelled, its piercing screams were irrevocably recorded on the same machine. That phonograph is now a receptacle of every known noise peculiar to babyhood. It is Mr. Edison's intention to take a record of the strength of the baby's lungs every three months. "I will preserve the record," said he, "until the child becomes a young lady. Then the phonograph can be operated for her benefit, and she can see for herself just what kind of a baby she was, and won't have to take her mother's and the nurse's words for it."

BURNING NATURAL GAS.

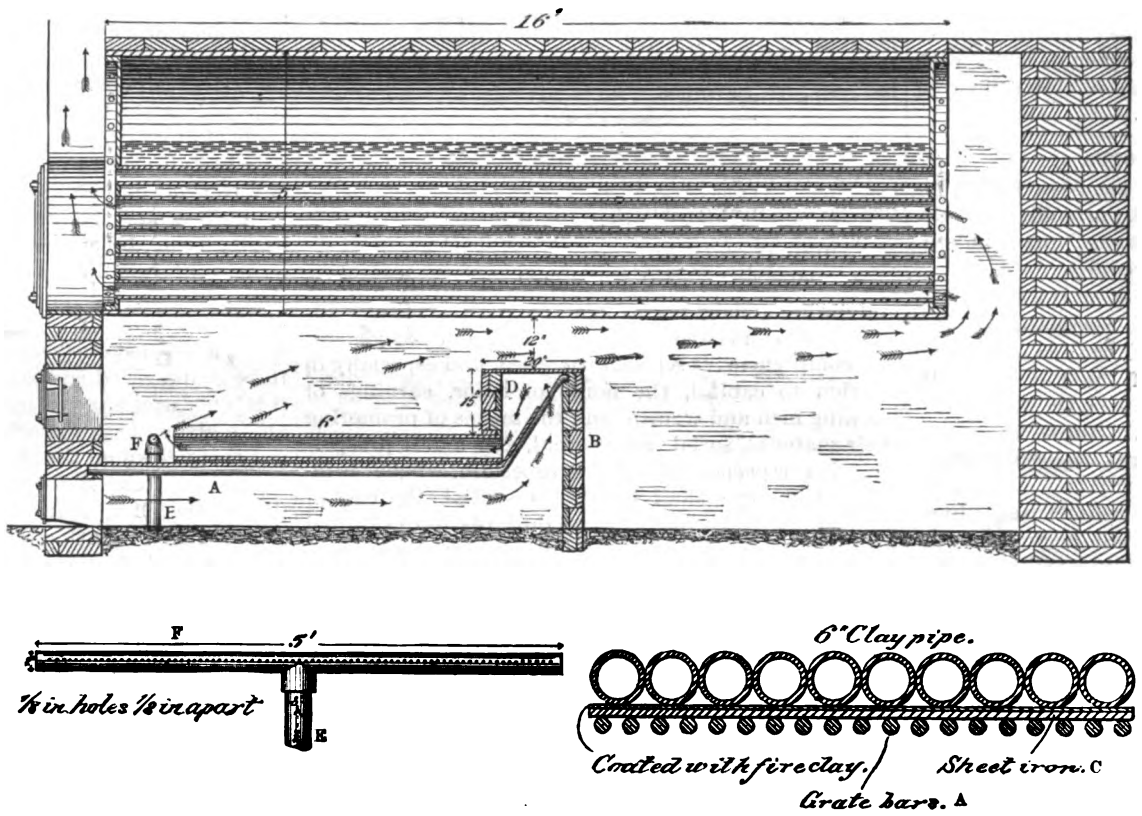
We are indebted to Prof. Henry L. Mott for a description of a new burner for burning natural gas under steam boilers now extensively used at Toledo, Ohio, and in other places. We give herewith an illustration.

The boiler is set in the usual manner. A series of grate bars, A, are arranged above the ash pit, their rear ends being inclined and terminating in the fire wall, B. Upon the tops of the bars is laid a sheet iron covering, C, which extends in height to about three-quarters of the length of the rear parts of the bars, the remaining portions of the bars being uncovered. On the top of the sheet iron covering is placed a thin layer of fire clay, and upon the fire clay is placed a series of clay pipes, six inches in diameter.

Above the inner ends of the clay pipes is a fire brick wall. A sheet iron cover, D, extends across the tops of the two walls. The gas is delivered through the pipe, E, to the horizontal pipe, F, which is furnished with a series of perforations which are arranged opposite the outer extremities of the clay pipes.

In operation, the air enters through the ash pit and rises into the chamber above the rear ends of the grate bars, where it strikes against the iron plate, D, which is at all times highly heated. The contact of the air with this plate heats the air to a high degree. It then passes on in the direction of the arrows through the clay pipes to the gas burner, F, where the hot air becomes mixed with the incoming gas and the latter is inflamed, producing almost perfect combustion at a high heat.

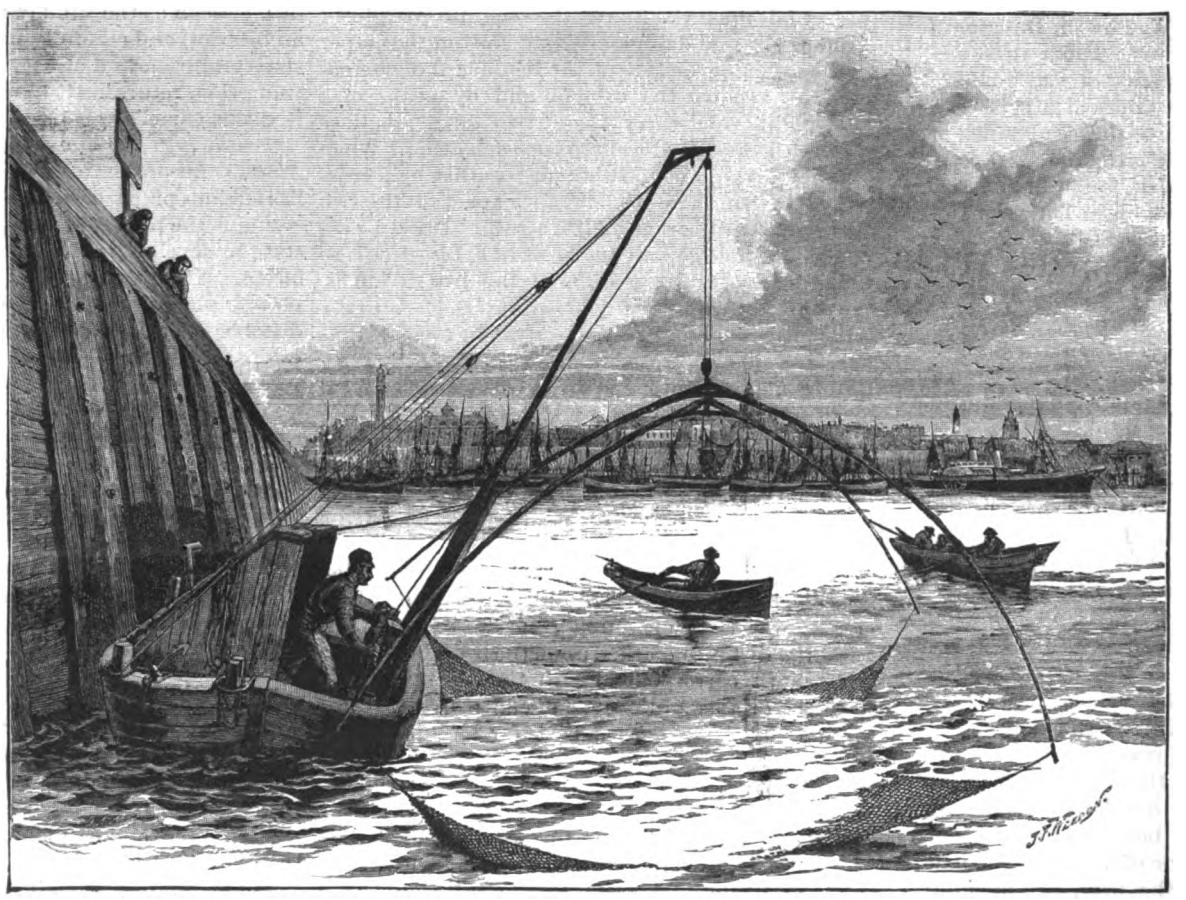
The products of combustion pass over the fire walls, under the boiler to the rear thereof, thence through the tubes of the boiler to the up-take, G. The arrangement is very simple, highly effective, and is being very extensively adopted.



ARRANGEMENT FOR BURNING NATURAL GAS.

CATCHING BAIT IN CALAIS HARBOR.

Line fishing as well as net fishing contributes largely to "the harvest of the sea," and is much used for taking cod and haddock in the German Ocean; the lines run out to a length of 300 feet, with a hundred hooks on each line, baited with mussels, whelks, or limpets, or with small pieces of herring or whiting. Eight such lines may be thrown out from one boat. So many vessels are engaged in this kind of fishing that it becomes difficult to obtain a sufficient supply of bait; and where shellfish do not abound on the shore, but must be imported from distant places, it is a costly item of expense. Mussels are largely cultivated for this purpose on the western coast of France, at Esnandes and Aiguillon, near Rochelle. Cuttlefish also make very good bait. There is a considerable variety of marine mollusks available for tempting the more valuable fish to the hook, and fish of less price can be cut up to use for bait. In Calais harbor, and in other ports of the Channel, these are obtained by large drop-nets lowered from the switches fixed to the mast of a boat, or from the pier, as shown in our illustration. The produce is readily sold to fishermen, who require great quantities of fresh bait. It will be remembered that in the disputes with the French about their fishery rights off Newfoundland, and with the Americans respecting their admission to the Nova Scotia and New Brunswick fisheries, the question of their being allowed to purchase bait has been regarded as an important point in the diplomatic negotiations.
—*Illustrated London News.*



CATCHING BAIT IN CALAIS HARBOR.

The Naphtha Launch Abroad.

Another new American invention is drawing attention in Europe. The London *Times* says: A launch, the engines of which are driven on a new principle—namely, by the vapor of naphtha—has just reached England from America, and has been inspected by us at Mr. Rowland Ward's, 166 Piccadilly, London.

The launch is 18 feet long by 5 feet beam, and 2 feet 6 inches deep, and is fitted with a two horse power naphtha engine driving a screw propeller. She will carry from six to ten persons at a stated speed of from six to eight miles per hour. In her bows is a stone tank capable of holding between 30 and 40 gallons of deodorized naphtha. Close in the stern of the boat are the engines and vaporizer, which only cover an area about 18 inches square, thus affording far greater space for passengers than in a steam launch of the same size.

The oil vaporizer or retort, which corresponds to the steam boiler of an ordinary engine, is a coil of tubing, and to start the engine this coil is first heated by a burner placed beneath it. By means of an air pump fixed near the engine, and worked by hand, air is forced into the naphtha tank and returns thence to the burner in the form of a gas, which is ignited and heats up the retort. When sufficiently heated, which will be in the course of a few minutes, a naphtha pump is started by hand, and naphtha is pumped from the tank in the bows to the retort. Here it becomes vaporized, and when the pressure is sufficiently high, as indicated by a gauge, the vapor is admitted to the cylinder of the engine, which is now driven by it, and which in turn drives the screw propeller. The gas burner is now no longer supplied with gas by means of the hand pump, but with fuel from the retort by means of an injector. When once started, the engine feeds itself and performs all other necessary functions. Speed and pressure are regulated by the injector valve, which is opened to increase and closed to reduce the speed. The forward and backward motions of the engine are governed by the turning of a hand wheel. The naphtha vapor, after having done its work in the engine, is condensed and forced back into the tank to be reused. The consumption of naphtha is that due to the heating burner, and with a two horse power engine this is stated to be from three quarts to one gallon per hour.

There are many advantages attendant upon this system of propulsion, which was described by Mr. Yarrow at the last meeting of the Institution of Naval Architects, and illustrated by drawings of a 40 foot launch built and engined by him on this principle. In the first place, there is more room for passengers than in an ordinary steam launch, as the engine and retort occupy so small a space. Then there is rapidity in getting up power, starting and stopping, and great cleanliness, which is due to the absence of the dirt and dust accompanying the use of coal. The launch being exhibited in a house, there was, of course, no opportunity for testing any of her working points. If we assume all that is stated on this head to be correct, however, the system would appear to have a very promising future before it, particularly for pleasure craft.

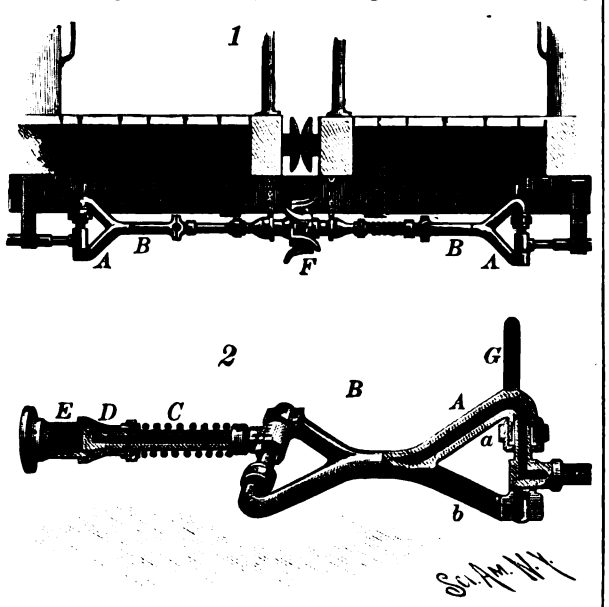
Mineralogical Notes.

At the last meeting of the New York Academy of Sciences, Mr. George F. Kunz exhibited some of the finest red corundum (ruby), from within twenty miles of Atlanta, Ga. This was in pieces weighing one pound, and was part of a mass weighing 350 pounds which was found on the surface. He also exhibited gold quartz from Dutch Guiana (gold formerly found there only in placer deposits had been traced to the vein by a brother of the United States consul, Mr. Thomas Brown), and exhibited specimens said to have assayed $450 to the ton. The mines are situated four miles from Parimaribo, and the ore is sent to the coast by natives, who carry it on their heads in fifty pound bags, making two trips a day.

He also read a paper entitled "List of Diamonds Found in the United States," which will be published later by the society, and stated, in reference to the diamond weighing 4⅛ carats, exhibited and reported by him two months ago as having been found near Morrow Station, 13 miles south of Atlanta, Ga., that he had recently heard of a two carat stone which was brought to Mr. L. O. Stevens, of Atlanta, Ga., by a colored man, who found it in his garden a few miles from the city, but who would not sell it or allow it to be sent North. It was imperfect and off-colored. Mr. Kunz also said that five years ago he had identified topaz for the first time in Maine, at Stoneham, and ever since then he had been on the lookout for the rare gem phenacite, crystals of which he had the pleasure of showing on that evening. This was the first time it had ever been found in the United States outside of Colorado, where it was first discovered in 1882. In Maine, a number of superb light green and sherry colored topaz crystals were found. They were several inches in length, but of little gem value.

AN IMPROVED STEAM COUPLING FOR CARS.

A coupling for automatically establishing or breaking tubular connection between the cars, or engine and cars, of a train, for conveying steam, air, or water, etc., for warming, ventilating, or analogous purposes, is illustrated herewith, and has been patented by Mr. James I. Collins, of No. 53 Willow Street, Amsterdam, N. Y. Two Y-shaped conductors, A, B, are employed, one member of which, *a*, is tubular, the other, *b*, being made solid to serve as a bearing for connections. The tubular member is carried inward to align with the outer end of the solid member, and is received in one end of an L, held to turn freely in a packing gland, making a hinged steam tight connection. The shanks of the Y conductors are connected by a nipple in such manner that one will occupy a horizontal and the other a vertical position under the car platform, as shown in Fig. 1, both sections being made alike. Into the outer end of the L is screwed a tubular rod, C, surrounded by a spiral spring, the unattached end of the rod being closed, but having a conical enlargement, with a side aperture, and being received and packed to slide in a sleeve, D, to act as a valve. A section of tubing, E, is screwed into this sleeve, having on its outer end a disk with small central aperture, there being on the outer face of the disk a rubber or other flexible packing ring, to make a close joint when brought in close contact with the similar disk of another coupling. The periphery of this disk is furnished with projecting tooth-shaped guides, F, so that when the disks of opposing couplings are brought together, they will be automatically guided to their proper relative position to insure firm contact. The coupling is supported at its outer end by a chain attached to the sill of the car, its inner end being sustained by a staple, G, from a bracket beneath the car. When the disks of these couplings, fitted on opposing cars, are brought in contact, they



COLLINS' STEAM COUPLING FOR RAILROAD CARS.

are each forced backward, causing the sleeve to slide back upon the rod, C, whereby communication will be opened for the passage of steam, hot air, etc., from one car to another, the uncoupling and separating of the cars causing the automatic closing of such communication, as the spiral spring then forces the valve sleeve and disk outward.

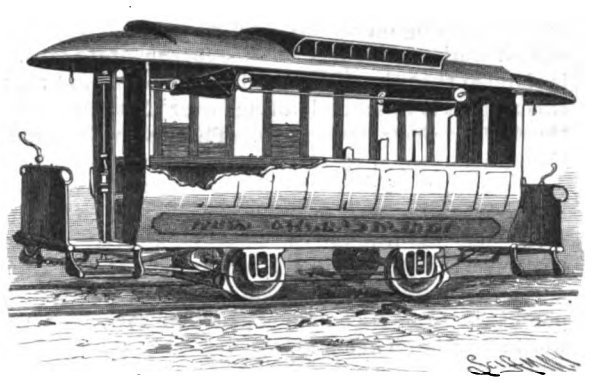
AN IMPROVED COPY HOLDER.

A device which can be readily attached to and detached from either the upper or lower type case, to hold copy in position to be easily read by the compositor in setting up type, is illustrated herewith, and has been patented by Mr. Hugo F. Maas, of Egg Harbor City, N. J. It has a double U-shaped clamp, of wire or sheet metal, with a medial spring plate so dividing the clamp that it may be attached either to the partitions between boxes or to the outer thick frame of the case. A bent arm projects upwardly in double curved form from the clamp, such arm having a flat socket at its upper end to receive tightly a flat tongue, fixed to the lower edge of a copy-supporting rack, made with a lower back plate and skeleton frame, across the upper part of which extends a longitudinal wire. The ends of the back plate have lugs in which is journaled a longitudinal rubber-covered roller, so close to the back plate that copy passed under it may be moved up or down by turning the roller, which has on one end a milled disk for such purpose.

MAAS' COPY HOLDER FOR COMPOSITORS.

AN IMPROVED FAN FOR CARS.

A fan attachment for cars or other vehicles, adapted to be operated by the movement of the car, and



LE BEAU'S FAN FOR CARS.

capable of being readily made inoperative at will, is illustrated herewith, and has been patented by Mr. J. M. Victor Le Beau, of 51 North Peters Street, New Orleans, La. On one of the wheel axles is a pulley, which, by a belt, drives a pulley on a vertical shaft having suitable bearings on one end of the car, adapted to be clutched with and unclutched from another shaft in line therewith and extending to the top of the car. Upon the upper end of the latter shaft is a pulley, a belt from which operates a horizontal shaft mounted transversely in the upper part of the car, carrying a fan. One or more similar fan shafts with fans may also be operated by belts or cords from the first fan shaft. The preferred connecting means between the ends of the vertical shafts communicating power from the car axle is by having their adjacent ends squared, and sliding thereon a square apertured sleeve. This sleeve has an eye at its upper end adapted to engage a spring hook on the upper shaft, to hold the sleeve away from engagement with the squared portion of the lower shaft, when the fans will not be operated, but on releasing the hook the sleeve will slide down far enough to embrace the end portion of the other shaft, when the fans will be set in motion.

Unlooked-for Results.

How slight a circumstance may determine a man's destiny! It was Darwin's voyage in the ship Beagle that, without doubt, laid the foundations of his marvelous success as a naturalist, and ultimately gave to the world "The Origin of Species." Had he not had the wonderful opportunities, suggests the *Western Druggist*, which this trip around the world afforded him for the observation and study of natural phenomena, he would probably have been known to the world only as a somewhat heterodox clergyman of the Church of England, who had little love of theology but a kind and generous heart and a passion for the study of beetles and plants. His father's opposition at first led him to decline the proposed voyage, and when afterward he was led to reconsider the matter and make a visit to Capt. Fitz-Roy, the commander of the Beagle, that disciple of Lavater came very near rejecting him, as was afterward confessed, on account of the shape of his nose! The commander had grave doubts whether any one with a nose like Darwin's could possess sufficient energy for such a voyage.

According to Sir John Lubbock, the great physiologist and physicist Helmholtz dates his start in science to an attack of typhoid fever. This illness led him to the acquisition of a microscope, which he was enabled to purchase, owing to his having spent the autumn vacation of 1841 in the hospital, prostrated with typhoid fever; being a pupil, he was nursed without expense, and on his recovery he found himself in possession of the savings of his slender resources.

New British Cruisers.

The British government have now in course of construction five fast cruisers. These vessels are to be of a new type, their leading feature being a combination of high speed, quick-firing guns, protective deck, and moderately heavy armor. Three of the vessels of this new class are being built in royal dockyards at Chatham and Portsmouth, and two of them are being built by the Fairfield Shipbuilding Company, Glasgow. The first of the fleet to be launched was the Magicienne, which left the ways at Fairfield on the 12th of May. The vessels are of a displacement of 3,000 tons, and their engines are of 9,000 horse power. The speed expected to be obtained is 20 knots. The engines are being made by Messrs. Hawthorne, Leslie & Co., Newcastle-on-Tyne.

The hull is 265 feet long, 42 feet broad, and the moulded depth is 23 feet. It is divided into seventy-five watertight compartments, the engine and boiler space consisting of four of these. The steel protective deck is 1 inch thick in the center and is 2 inches thick in the angles. There are two complete decks running fore and aft. The vital parts are all below the water line. The stem consists of a casting of phosphor bronze, the stern post being made of the same material. The armament will consist of nine 6 pounder Hotchkiss guns, a number of Nordenfelt guns, and six 6 inch 5 ton Armstrong guns. The engines will consist of a pair of horizontal surface-condensing engines, the dimensions of the cylinders being respectively 34½ inches, 51 inches, and 76½ inches diameter; stroke, 36 inches. There are four double-ended cylindrical boilers to work at a pressure of 155 pounds, with a grate surface of 456 square feet. There are twenty-four corrugated furnaces.

AN IMPLEMENT FOR TRANSPLANTING PLANTS.

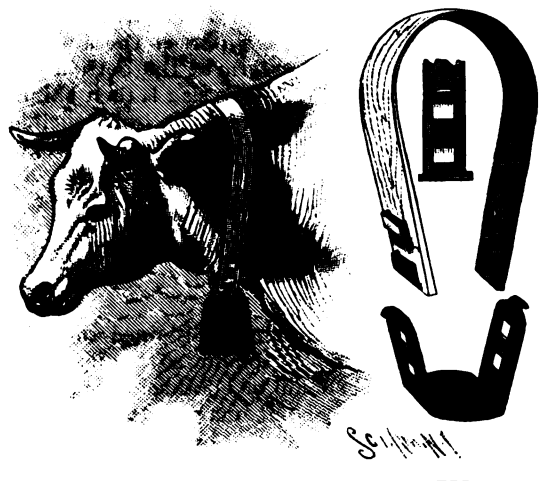
A simple and easily manipulated implement, by the use of which plants may be removed from the ground without disturbing their roots, and by which also holes may be made for the reception of plants, is illustrated herewith, and has been patented by Mr. Thomas R. Coon, of Hood River, Oregon. It is made with an annular band form of earth-cutting blade, combined with the jaws of a tongs. The tongs are so arranged that their handles when closed will close the inner jaws, to which the ends of the band-shaped blade, of spring steel, are attached, the bottom of the blade being beveled or sharpened, and its upper edge embracing a smaller circle than its lower edge, making the central opening slightly cone-shaped, as it is enlarged or contracted when the jaws are opened or closed. The manner of using such an implement in different kinds of soils will vary somewhat, according

COON'S TRANSPLANTING IMPLEMENT.

to the facility with which more or less soil may be removed with the roots of the plant.

AN IMPROVED BELL COLLAR FOR CATTLE.

A simple and efficient bell collar for carrying cattle bells, which may be worn by the animal with more comfort than the leather straps ordinarily used, is illustrated herewith, and has been patented by Messrs. John R. and Elijah R. Hill, of New Albany, Miss. The yoke is made of bent wood, having projecting staples near its extremities, and to its lower end is fitted a metal plate clasp having rectangular perforations for receiving the staples, the ends of the arms of the clasp being bent outward to form fasteners for a T-shaped leather tongue, which is slipped to place within the staples underneath the curved extremities of the arms of the clasp. The bottom part of the clasp, between its arms, has a leather covering for receiving the wear of the staple of the bell.



HILLS' BELL COLLAR FOR CATTLE.

Work and Wages in Holland.

A royal commission, composed of seven members, one of whom was a working carpenter, was appointed in Holland about two years ago to inquire into the condition of the working classes in that country. The commission sat for about eighteen months, and their preliminary report has recently been published. The report states that in Amsterdam the bakers work from fourteen to sixteen hours a day, in some cases for twenty-six hours at a stretch, this excessive labor being due to the competition of the large bread factories which have recently been opened, and in which the labor is from twelve to fourteen hours.

There are 5,000 working tailors, nearly all of whom work in their own homes, only one merchant tailor having shops in which the sewing machines are driven by steam, and give employment to 200 women and girls. Foreign competition is very great in the tailoring trade, and the Dutch tailors have to work very hard during the season, which lasts only three months. The workmen employed in diamond cutting—of whom there are 5,000, nearly all Jews—at Amsterdam are the best paid, as they earn from $16 to $18 and $20 a week, working twelve hours at a stretch. In the factories for making bread, vinegar, sugar, etc., in the breweries, sugar refineries, and steam mills, work is carried on both by day and night, there being, of course, two sets of workmen, though when a man belonging to one set is ill or absent, his place is taken by a man of the other set, who is thus obliged to work for 24 hours at a stretch. The royal commission, while admitting the difficulty of obtaining accurate information in all cases, states that, as a rule, adults work from thirteen to fourteen hours a day, and that out of 11,156 workmen in the province of Lemburg, which is taken as a typical case, 7,011 were men, 240 married women, 733 unmarried women, 365 girls between sixteen and eighteen, 614 girls between twelve and sixteen, and 2,193 boys under eighteen, 39 per cent of the total number being minors. A law passed in 1874 prohibits the employment of children under twelve, but the commission reports that it is not very strictly enforced, and, moreover, that children are made to work almost as long as adults. Nor does public instruction appear, despite the law passed in 1874, to have made much progress, for in Amsterdam alone 4,606 children did not attend any school at the beginning of last year, while the mean average of persons unable to read or write in Holland is 10 per cent, as against about 2 per cent in Germany. The commission states that the rates of wages may be taken at 4c. an hour for men, 3c. for women, and 2c. for children in the linen trade; while bakers earn 4c., paper makers 5c., sugar refiners 6c., painters and compositors 7c., for certain painters 12c., and engravers 16c. per hour. For ordinary workmen 6c. an hour may be taken as a *maximum*, which is 56c. a day, or $2.50 a week, supposing the man to work ten full hours. There are a good many mutual relief societies in Holland, especially in the factories, and the employers themselves subscribe in several cases. A Dutchman working twelve hours a day produces much less and is not nearly so well paid as an Englishman working fewer hours. The commission concluded its report by recommending the government: 1, to provide for the inspection of factories; 2, to execute more strictly the law relating to infant labor; 3, to prohibit women and children working by night or on Sunday; 4, to make periods of rest for both of them compulsory; 5, to prohibit women working for at least a month after their confinement. The Dutch government has introduced a bill which, in some respects, goes beyond, but in others does not come up to, the recommendations made by this commission.

Aluminum.

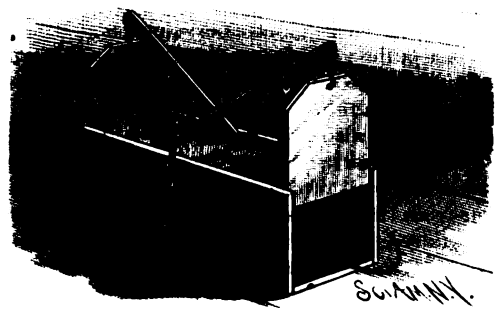
The process of Professor Curt Netto, of Dresden, now in experimental operation at Krupp's works, Essen, and in London, is a chemical process based on the displacement of aluminum from its ores by metallic sodium. The ore used is cryolite, a double fluoride of aluminum and sodium. This is ground to a fine powder, and is fluxed with common salt. The ore is then melted in a reverberatory furnace, and when quite liquid is run into a ladle. When in this condition ingots of solid sodium are forced to the bottom of the ladle, and are there held until they become volatilized, the work of a few moments only. The gaseous sodium rising through the molten cryolite displaces a part of the aluminum, which collects in a metallic form at the bottom of the ladle. The greater part of the slag is then skimmed off, and the remainder poured into an iron crucible to cool. When the mass is turned out, a solid ingot of aluminum is found at the bottom. The whole of the aluminum in the original charge of ore is not obtained at each operation, and the slag is therefore returned to the furnace with more cryolite. After the first charge the addition of salt is not required, as the slag serves the purpose of a flux.

For each pound of aluminum obtained there is required about 3½ pounds of sodium, so that it is important that this metal should be obtained cheaply. The Alliance Company, London, manufacture it at their works, the process, as described to us, being as follows, says *Engineering:* Pure caustic soda is melted in a pan, and then ground coke is stirred into it; 100 pounds of the mixture are ladled at a time into a long, narrow retort, lying in a furnace. The carbon effects the reduction of a part of the soda, metallic sodium being distilled off and caught in a condenser, while carbonate of soda is left in the retort. When the reduction is complete, the carbonate of soda is run off, and a fresh charge introduced, and so the process goes on. We were not informed what was the cost of the metal obtained, but it should not be greater than that obtained by the Castner process, which is stated to be 1s. a pound. Possibly it is less.

We saw a 5 pound ingot produced, the time occupied from charging the furnace to weighing the ingot being less than an hour. The cast was one of a series which had been going on all day, and was carried out by unskilled workmen with a small experimental plant. It is claimed that the metal produced is pure, and that in this respect it has an advantage over that obtained by the various electric processes. The cost of its production is set down at 6s. ($1.50) a pound, while the present selling price is 48s. ($12) a pound. Since aluminum bronze requires only 5 to 10 per cent of aluminum, while steel and iron only need to be alloyed with one-tenth per cent to obtain the full benefit of the combination, it is evident that aluminum at 10s. ($2.50) a pound would be a commercial article for which there would be a large demand.

AN IMPROVED ANIMAL TRAP.

A trap designed especially for use as a mouse or rat trap is illustrated herewith, and has been patented by Mr. Charles H. Mittler, of Marthasville, Mo. Within the box is mounted a tilting platform, to be turned either way by a slight touch from the animal, thus releasing a hooked catch and freeing an arm which holds down levers, by which the sliding doors, closing openings at both ends of the trap, are held up. A pin on which to place bait is fixed in the face of the tilting block. These traps may be made of either wood or metal.



MITTLER'S ANIMAL TRAP.

[SIDEREAL MESSENGER.]

Astronomical Notes.

Mars' Satellites.—It may be interesting to some of our readers to know how the tiny satellites of Mars look in the great Lick equatorial, as they have been observed night after night by Assistant Keeler, during the month of May. In conversation with a friend he recently said these minute bodies looked in the great refractor as bright as the companion to Polaris does in a three inch telescope. Mr. Barnard's estimate of their brightness in April was that they were equal to Jupiter's satellites when viewed with a glass of 1½ inches aperture. They are evidently easy objects to observe in the world's greatest refracting telescope.

Map of Solar Spectrum.—At the April meeting of the National Academy of Sciences, Professor Rowland, of Johns Hopkins University, presented two brief papers, giving further studies on certain spectra. With new and improved instruments, made at the university, it is claimed that he has succeeded in making a much more perfect map of the solar spectrum than his former one. Definition of the lines is better, and some single lines have been divided. He also claims the discovery that carbon is much more widely distributed in the sun than has previously been known.

Dearborn Observatory.—In a recent letter from Professor Hough, we learn that all the astronomical instruments belonging to Dearborn Observatory have been removed to Evanston, the new site of the observatory. Plans for the new building have been adopted, and its erection was to begin about the 1st of May, but the 18½ inch equatorial will not be mounted before January, 1889. The meridian circle has been placed in a temporary building, located 250 feet from the shore of Lake Michigan. Professor Hough says the lake seems to have no effect on nadir observations, at least a moderate storm does not disturb the images perceptibly. In case of a gale, he thinks it is possible that tremors would be felt. The site of the new observatory is to be 250 feet from the lake shore.

Professor Hough is now arranging for the time service for Chicago from his new location.

Denver University Observatory.—A recent letter from Professor H. A. Howe, of Denver University, Colorado, discloses the interesting fact that the observatory at that place is to have a new equatorial refracting telescope, the aperture of whose object glass will be 20 inches. This is good news for the university and for Professor Howe, who well deserves the recognition it implies. For so young a man it is a noteworthy stride in his favorite science to have a telescope that ranks fifth in size and power in the United States; for those at Lick Observatory, Washington, University of Virginia, and Princeton only now are larger. Another significant fact in this new enterprise is the altitude of the site, which has been chosen on the new "campus" of the university, about seven miles from the city of Denver, and is 5,000 feet above sea level. If memory serves us rightly, this site is higher than that of any other large telescope in the United States, the Lick site being next, at an altitude of 4,200 feet. The name of the generous donor of this large instrument is Mr. H. B. Chamberlin, of Denver, Colorado.

Paper Pulp from Cotton Stalks.

For several weeks, says the Atlanta *Constitution*, there have been on exhibition in the office of the clerk of the Superior Court samples of pulp made of the hulls and stalks of the cotton plant. The pulp is as white as snow, and can be converted into the finest writing paper. It is regarded as valuable, and is the product of parts of the cotton plant hitherto deemed valueless.

The process by which it is made is new. It is a process by which the ligneous substances of the hulls and seed are dissolved. By this process over fifty per cent of the fiber is extracted from the hulls, which have been regarded as fit only for fuel in the mills or for feed and fertilizing purposes, and which were sold for four dollars a ton. These, converted into pulp, will be worth about forty dollars a ton. From the stalks usually left to rot in the fields this new process utilizes about thirty-eight per cent of fiber at a very small expense. It has been settled that there are fertilizing properties in the oil of the cotton seed, and it is asserted that the fiber will not decompose for six years and cannot be used as a fertilizer. This is why the woody matter eliminated from the stalk and hull is much more valuable as a decomposing fertilizer than the entire seed. By the same process the ramie plant and its troblesome cousin, the bagasse stalk, is met and overcome. By the decorticating process the fiber was crushed and torn out by a slow and expensive process.

In the new process the ligine is simply dissolved out, and the snowy films of the ramie and the tawnier threads of the sugar cane are coaxed out as easily as the infantile kitten to its milk.

Alcohol.

Among the curious side issues of the current temperance discussion is the question whether alcohol is a natural product. This is, I believe, vigorously denied in some quarters. Alcohol, like bread, is manufactured artificially from a natural product. In each case fermentation, a natural process, is made use of. But while bread is known only as a product of manufacture, alcohol appears to be very widely distributed in nature, though in extremely minute quantities. Nor is this at all surprising. If grapes or apples, or their juice, be exposed to the air, fermentation sets in, and the sugar and other carbohydrates are changed to alcohol. The ferments which cause the change are afloat in the air all about, and might not unnaturally attack similar compounds in other vegetable substances. Professor Muntz, of the National Agronomic Institute, in Paris, has, by refined chemical tests, discovered evidences of alcohol in cultivated soils, in rain water, in sea and river water, and in the atmosphere. He finds that vegetable moulds may contain considerable quantities, and it appears probable that the alcohol "originates in the soil, from the fermentation of the organic matters in it, and is thence diffused as vapor in the atmosphere." Another side issue of our temperance discussion is the so-called "Bible wine" theory, which maintains that the wine used in Palestine in the time of Christ was not alcoholic. I have been unable to find evidence that the composition of the juice of the grape, the laws of fermentation, or the practice in the making and using of wine were different in that country at that time from those in other countries, or in that country at other times; and believe it safe to say that the theory that Bible wine was different from other wine, that it had not the alcohol which other wines contain, is without any basis to support it, in the opinion of the student of science.—*Professor Atwater, in the Century.*

Meeting of the American Association for the Advancement of Science.

The American Association for the Advancement of Science holds this year its thirty-seventh meeting at Cleveland, Ohio, from Wednesday morning, August 15, to Tuesday evening, August 21. The date of meeting has been advanced one week from that decided upon at the last assembling, on account of a gathering of Knights Templar to occur in Cleveland the third week in August. For all matters relating to membership, papers, and business of the Association, the permanent secretary should be addressed at Salem, Mass

Pebble Beach, Pescadero, California.

Officers of the coast survey have characterized the famous Pebble Beach of Pescadero as one unique of its kind and without a counterpart on the whole extent of our Atlantic and Pacific coast lines.

Its distinguishing feature is the mass of highly polished, pure silicious gravel bordering the sea at this locality, in which the topaz, carnelian, onyx, chalcedony, turquoise, agate, and jasper pebbles are found, buffed and perfected by ages of wave action as if by a lapidary.

Wave action has also eliminated all soft and angular minerals from the mass, save occasional fragments of abalone shells and chalcedony, and only the hardest stones survive the surf's eternal attrition.

Many of the topazes and carnelians are of rare clearness and beauty, and may be matched by patient search in size, form, and color for jewelry or for display in mineral cabinets.

Some fine pebbles of milk and fire opalescence are found; and the surf-polished crystals of pure, pellucid quartz gleam like dewdrops in the multicolored gravel.

The carnelians are of all tints, from blood-red to the palest pink or purple; and in some rare specimens the color is singularly confined to the middle of the stone, while the exterior is perfectly limpid.

Here, too, are found agates of every color and combination, the choice of which make handsome bracelets, watch charms, and other personal trinkets when cut and set. The smaller gems, however, of clear tint, perfect form, and suitable size, need no touch of art or lapidary's wheel, but in their natural state, set in contrasted colors, are jewels at once unique and of special interest. Stones of this class are generally small.

But chief among the mineral curiosities of the beach are the so-called "water drops," which are most abundant on a piece of sea marge north of the main deposit, known locally as "Agate Beach." These are chalcedony pebbles, more or less translucent, and usually about the size and form of a lemon drop, having a globule of water imprisoned in a central cavity, and an air bubble which, when small, looks dark by transmitted light and moves within like a living insect.

They are highly prized and much sought after by mineral and curiosity collectors. Mrs. General Dimond, of San Francisco, is accorded the credit of being first to discover and direct attention to these curios of the beach.

To the non-scientific the stone-imprisoned water is a mystery not less puzzling than the milk in the cocoanut. If it had percolated from without, it should be sea water; on the contrary, it is perfectly fresh.

The explanation is that the aqueous drop was inclosed by the silica during the process of crystallization.

These curios, though rare, are not unknown in other parts of the world. And they are occasionally met with in the vugs or cavities of quartz veins during mining operations.

It is evident, however, that only under exceptional conditions of temperature can they exist on the surface of the earth as at Pescadero, since either a temperature below 30° would freeze or powerful sun rays would expand the water within and fracture the silicious bulbs.

On other sea beaches, washed crystals of smoky and limpid quartz occur. Such crystals are plentiful at Long Branch, but I found there no other varieties worthy of note, and though many of these are beautifully clear while wet, they lose their limpidity when dry, owing to forcible impact one with another in the strong surf, which, as microscopic inspection shows, covers their surfaces with minute fractures.

At Pescadero, however, the silicious gem materials occurred in extraordinary variety and profusion. The sea floor and beach contour favored accumulation and a gentler attrition, and we have there in the fine lapidary finish of these lustrous stones the ultimate product of patient nature and the tireless sea toiling through untold lapses of time.

Pebble gatherers are enthusiastic in their pursuit, and return again and again to the charmed precincts of the beach for new varieties, more perfect specimens, or to complete "sets."

And surely no hobby could be more innocent, more full of restful enjoyment and physical good than the gathering of these pleasing and imperishable mementoes in the exhilarant sea air and climate of the Pacific coast, and in so delightful a locality.

But beyond its distinguishing feature, the Pescadero beach is otherwise interesting and picturesque. The receding tide leaves wide stretches of kelp-covered reefs, where fine sea mosses and the beautiful abalone univalves may be obtained by the more adventurous visitor. Here, also, are things of interest to geologist and naturalist in the lithology of the shore, the fantastic carving and surf sculpture of the rocks, the pebble-paved pools and basins in the uncovered sea floor, hollowed as if by art, fit baths for the sea nymphs or fabled Amphitrite, and natural aquaria rife with varied sea life, lined with mosaics of purple-spined sea urchins, limpets, and many-tinted sea anemones.

The botanist, too, especially one unfamiliar with the California flora, will find much of special interest in the wild flowers, grasses and shrubs of the immediate coast line, if he times his visit rightly, say in the period between March 1 and the close of July.

A mile in lineal extent north and south will embrace nearly all of the Pescadero beach deposit; and "Pebble Beach" proper is but a part of this, a crescent-shaped sweep of sea marge sheltered between rocky promontories and backed by arenaceous bluffs.—*Min. and Sci. Press.*

The Largest Artesian Well in the World.

A recent number of the Melbourne *Times*, Australia, contained an account of the opening of an artesian well at Barcaldine, in the interior of Queensland. The locality where the well has been sunk is far removed from any watercourse, and has frequently suffered severely from drought. The boring operations were commenced some time ago by Mr. J. Longhead, managing director of the Federal Boring Association, and no sign of water was met with till the 16th of December last, when the drill suddenly dropped 7 feet. Within a few minutes the water ascended the bore, rose several feet into the air, and then fell away into the form of a large glass dome. Its temperature then was 120° Fah., but soon afterward receded to 102°, and Mr. Longhead anticipates that it will go down to about 90°. Before the rods were removed, the bore was continued to a total depth of 691 feet 9 inches, so as to form a receptacle for any sediment, and prevent its interference with the course of supply. The rods were then lifted, and some additional casing was put in to preserve the sides of the bore where any weakness had been revealed. A pipe 17 feet long was inserted into the bore, and carried up to the top of the derrick, which had been used in connection with the boring plant, and over the top of this the stream of water, 12 inches in diameter, has seemingly been allowed to run to waste. The pressure indicated that had the piping been carried a much greater distance into the air, the stream would not have reached its natural level. It is supposed that the water is issuing at the rate of 400 gallons per minute, or 576,000 gallons per day. Mr. Longhead is of opinion that the supply is inexhaustible, and that its soft nature clearly indicates that it originally came from some snowy ranges.

New York Technical School for Girls.

We imagine that it will surprise most people to learn that there is a technical school in New York, exclusively for girls, which has been in existence fourteen years, and graduated this year a class of nine hundred and twenty-four members, or more than the united members of the graduating classes of boys in all the technical schools in the western hemisphere. It is true that the sciences taught in the school are not of a very abstruse character, but they are of the sort best adapted at present to help girls to earn an honest living, and many a woman must bless the thoughtful charity by which she was put in the way of independence. There is still something strange to an American in the modern movement by which women have entered into nearly all the departments of industry and trade which were once monopolized by men. It is not many years since a young girl's face was a rather rare sight on Wall or State Street, and those that were seen generally belonged to persons who were shyly hurrying by on their way to a ferry or railway station. Now nearly every broker's or lawyer's office and merchant's counting room has its gentle, industrious bookkeepers and typewriters, and in many cases these modest and faithful assistants are intrusted with very great responsibility. All the girls who wish to be employed, however, cannot find places as typewriters or bookkeepers, and it is a matter of much importance to the welfare of the sex to increase the number of occupations in which it can be of service. This sort of work is just what a technical school can do, and those who would like to see the weaker class of their fellow citizens placed in a position where they need not be dependent for support upon the uncertain mercies of their male relatives will do well to keep the New York example in mind.

Among the subjects taught in the school are stenography and bookkeeping, mechanical and free hand drawing, sewing both by hand and machine, cutting and fitting, music, designing, as applied to textile fabrics, wall papers, and tiles, and modeling. All the instruction given is free, and the salaries of the twelve teachers employed, as well as rent and other expenses, are paid by subscription, under the care of the Young Women's Christian Association. So far as the public is concerned, the education of women in all these, as well as other kindred subjects, is an unmixed advantage. Not only are thousands of intelligent persons changed from idle and often very poor consumers to industrious and comparatively affluent producers, but the introduction of so much trained skill into the practice of the domestic arts must before long show itself in the development of those arts. The manufacture of wall paper in this country certainly owes to a few clever women a great part of the extraordinary artistic success which it has achieved; and to take another example, the decorative embroidery of the Associated Artists, and of Mrs. Holmes before them, give a promise for the future of American art which is hardly to be found in the painting or sculpture of the country.

If we could suggest anything which might, with advantage, be added to the curriculum of this or similar schools, it would certainly be the development of the actual practice of artistic industry in other ways besides embroidery. There is no reason, for instance, why women here should not be as successful in decorative painting as the Misses Garrett and their rivals are in England. Most women are somewhat sensitive to color, but are so persuaded of their natural gift in this direction that they scorn to learn anything about the subject, and make, in consequence, laborious attempts at decoration which, to everybody except themselves, appear painfully ignorant and bald. If the same women would get rid of the notion that heaven has already taught them a business which their brothers spend years in learning, and would, like men, make themselves acquainted with the observations of such masters as Owen Jones, Dr. Dresser, and William Morris, and study and compare the work of different ages and countries, the beautiful forms of the antique and the Renaissance, the brilliancy of the Japanese, and the ineffable coloring of the Chinese, they could, more easily than most men, acquire a resource and certainty which would make them the best and most rapid of decorators. The same sort of training would fit them for other artistic professions. We cannot say that we think the system of making designs for tiles and similar things, for indifferent workmen to carry out, is calculated to develop the highest artistic capacity or produce the most beautiful art. The highest beauty can only be added by the artist's own hands, without the intervention of mechanics, and there is just now a wide field for the use of works of decoration which shall be as much autographs of the designer as an easel picture could be. To take a single example, a great deal of mosaic for the adornment of buildings is now made in Venice by an association of girls of good family, who draw and color the designs, pick out the bits of glass or stone, and send them to be put in position. Although mosaic is now a rare luxury with us, it might be popularized in this way to the general advantage. There is a sort of mosaic, useful either for floors or walls, which is made by gluing the bits of marble or glass on brown paper. The paper is then sent in sheets to the place where it is to be used, and laid with the bits of marble downward, on a bed of fresh Portland cement. When the cement has set hard the paper is washed off, and the mosaic finished by polishing with a stone. For the ornamentation of our vestibules and hearths very effective use might be made of this means. The broken bits of tile from the tile layers answer an admirable purpose for mosaic, and give far more richness of color than can be got with marble. These might be glued on sheets by a skillful hand in such a way as to form designs of a value infinitely superior to anything yet attempted in floor or permanent wall decoration, and at a price by no means extravagantly high.—*Amer. Architect.*

Heights of Clouds.

The cloud illumination caused by the electric lights of Detroit and Ypsilanti is occasionally so well defined in outline, as seen from this observatory, that it occurred to the director to inaugurate a series of altitude measurements for the purpose of determining the heights of all forms of clouds visible at Ann Arbor after twilight.

The central portion of Detroit is about 35 miles from the observatory, while Ypsilanti is only 5·8 miles distant. The azimuths of the two cities differ about 30 degrees, so that the conditions for determining the heights of the upper and lower clouds can always be made favorable when the atmosphere is sufficiently transparent. When the clouds are very high, the Detroit illumination is so well defined that the probable error of a single measurement of an altitude is only a few minutes of arc. When the clouds are low, the nearer illumination is well defined and the farther one either invisible or coincident with the apparent horizon. The greatest and least heights recorded up to the present time are respectively 17,580 and 770 feet.—*Amer. Meteo. Jour.*

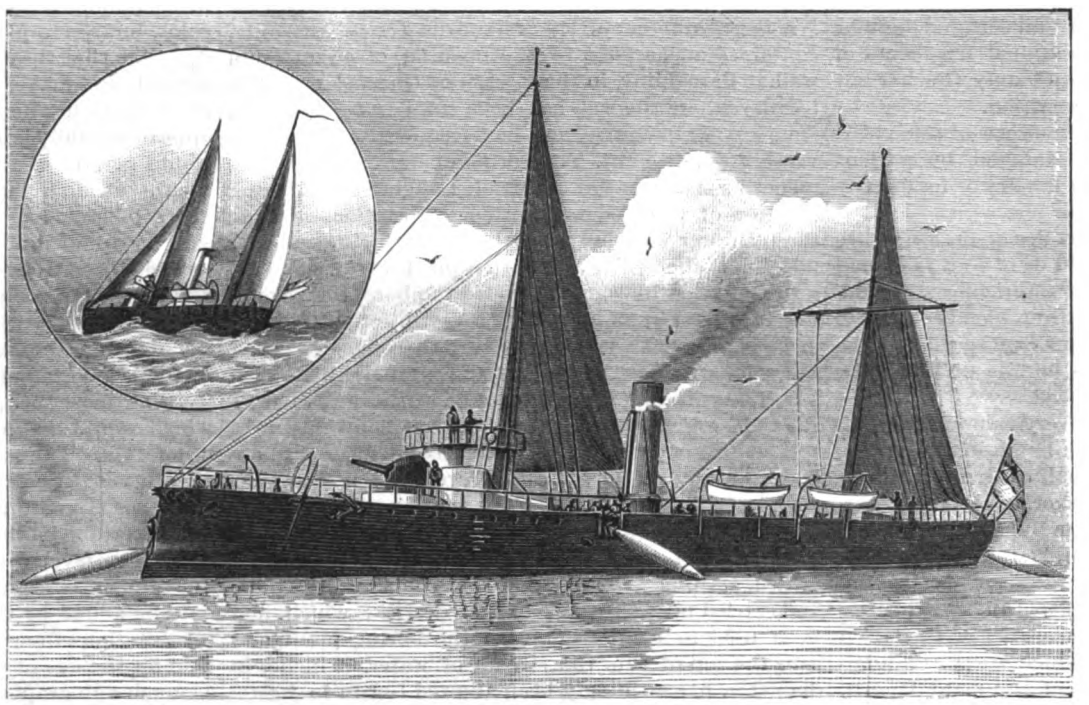
Electrical Patents.

The number of applications for patents on electrical appliances is phenomenal. During the week ending May 29, seventy-three patents were issued from the Patent Office. A general subdivision into various recognized departments is interesting, as showing those in which inventors are most busily engaged: There are 14 patents relating to instruments and devices of measurement and testing, 2 to telegraphy, 2 to the telephone, 3 directly to the motor, 4 directly to the galvanic battery, 4 directly to the secondary battery, 1 to a thermo-electric generator, 26 to dynamos and electric light apparatus and the transmission and distribution of electricity for purposes of light and power, 17 to miscellaneous applications. Among those relating to electric light apparatus are quite a number covering a whole alternating current system.

INSIDE AND OUTSIDE OF A TORPEDO VESSEL—H. M. S. RATTLESNAKE.

(*Continued from first page.*)

cubic foot to spare. The men are then packed like "herrings in a barrel" from deck to ceiling, one over another. But "Jack" does not seem to be at all unhappy in his quarters, and, as has always been from time immemorial with him, he good-naturedly shakes down and accommodates himself as circumstances will allow. The after-dinner hour is employed in various ways, such as writing, reading, singing, etc., as the spirit moves him. With all the sparse accommodation, it must be borne in mind that the vessel would seldom be long or far away from land, so that many of the crew would be, as a rule, on leave. Take her for all in all, the Rattlesnake is a smart, serviceable little craft. Her dimensions are: Length between perpendiculars, 200 ft.; extreme breadth, 23 ft.; mean draught, 10 ft.; depth, 16 ft. Her engines are very powerful (2,700 horse power), and the tonnage 450. She was built and furnished with engines by Messrs. Laird, of Birkenhead.—*The Graphic.*

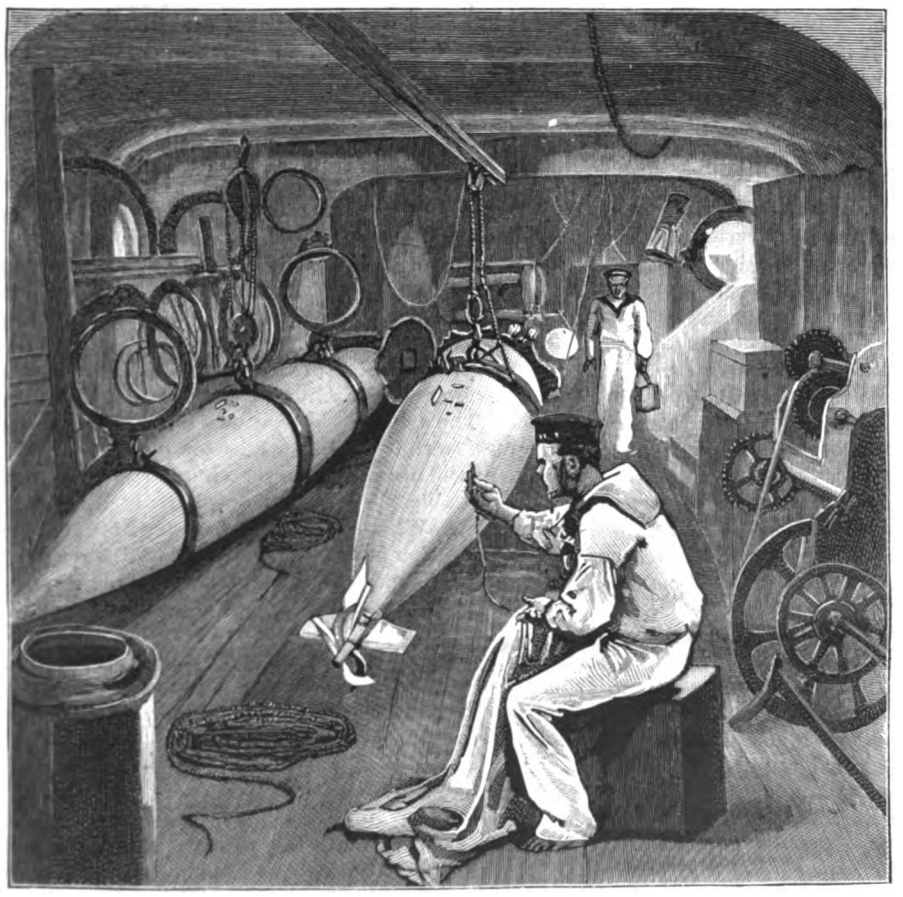


THE RATTLESNAKE LAUNCHING TORPEDOES.

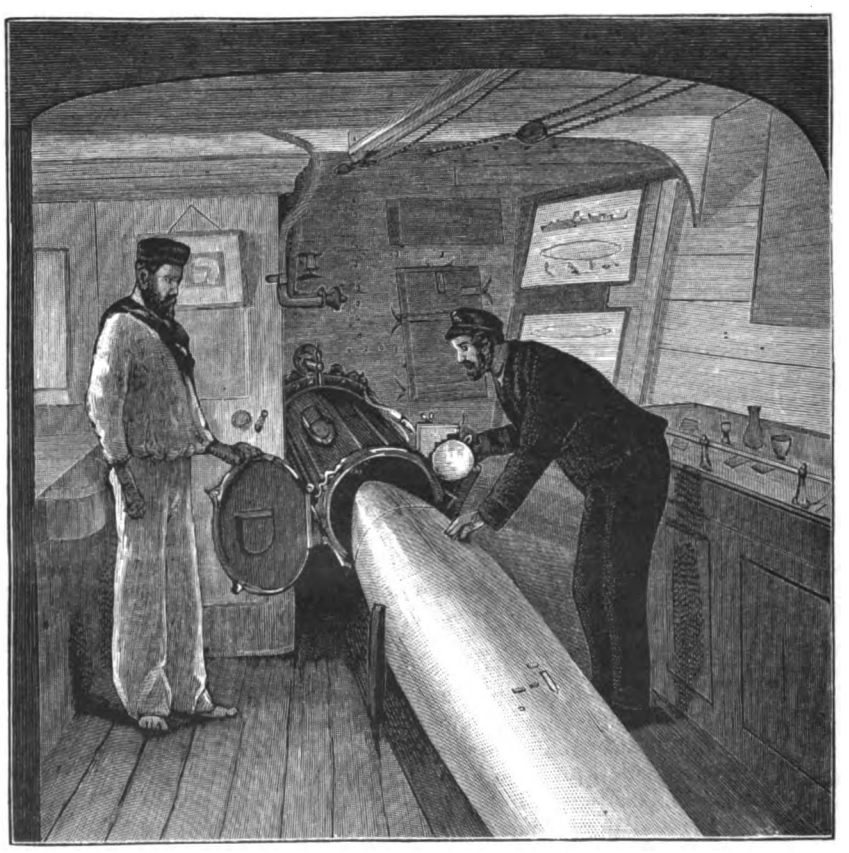
Modern Heavy Artillery.

No limit can be fixed to the possibility of science, and with increasing mechanical ingenuity and improvements on existing types of ordnance we may expect that larger and more destructive weapons than have yet been constructed will be called into existence. Thirty years ago it was considered that no gun exceeding 5 tons in weight could be worked on the deck of a ship. To-day, guns weighing 110 tons are loaded and manipulated on shipboard through hydraulic agencies with the greatest ease. Muzzle loaders have been superseded by breech-loaders, and power and range are ever increasing. The 80 ton muzzle-loading guns of the Inflexible are already considered obsolete, and are exceeded both in range and power by the newer type of breech-loading 67 ton guns carried by the Trafalgar. The Inflexible 80 ton gun is built of iron coiled around a steel tube, and is 27 feet long. The new 67 ton gun is built wholly of steel, and has a length of 36 feet, with a caliber of 13·5 inches. The charge of powder used in the latter gun weighs 630 pounds, and provides the projectile, which weighs 1,250 pounds, with as much energy at a range of 1,000 yards as the projectile from the 80 ton gun possesses at the moment it leaves the muzzle.

At a range of 1,000 yards the projectile from the 80 ton gun is capable of penetrating 23 inches of unbacked wrought iron, while the projectile from the 67 ton gun will penetrate rather more than 27 inches. The Trafalgar's guns are somewhat insignificant when compared with the 110 ton guns of the Benbow. The projectile fired from the guns of the latter ship weighs 1,800 pounds, and is capable of penetrating 35 inches of wrought iron at a range of 1,000 yards, the charge of powder used weighing 900 pounds. Our 110 ton guns have already been surpassed by the Krupp 118 ton guns, which were supplied to the Italian government a short time ago. With these guns a wrought iron plate of 41 inches in thickness can be penetrated near the muzzle, and 39 inches at a distance of 1,000 yards. Their length is about 46 feet, and weight, including breech mechanism, 118 tons. They are made entirely of crucible steel, and are without trunnions, the connection with the carriage being made by means of ring projections. During experiments with these weapons results were obtained which are stated to be the highest realized with any existing cannon. These achievements, however, are soon likely to be surpassed by the production of other monster weapons by Krupp, of Essen. Designs for a 139 ton gun already exist, the projectile from which would be capable of piercing a wrought iron plate 45 inches thick; and report says that a piece of ordnance to weigh 150 tons is in contemplation at Essen. What is the limit of weight of gun to be carried on shipboard? And when is all this rivalry in heavy guns to cease? A few months pass away, and what was new and startling becomes old. Reasoning from the past, it would seem that even our 100 ton guns may soon fall into comparative disrepute, and others more powerful may hold supremacy.—*Industries.*



DYNAMO ROOM IN THE FORE PART OF THE VESSEL.



LAUNCHING A TORPEDO FROM THE STERN.

Steam for Car Heating.

Mr. C. F. Choate (president Old Colony), George A. Torrey (attorney Fitchburg), and Richard Olney (attorney Boston & Maine) have printed a communication in which they severely criticise the Massachusetts railroad commissioners in requiring the heating of passenger cars by steam from the locomotive.

So far as the Boston and Albany is concerned, the general impression is that its experience during the last winter has made it extremely doubtful whether it is possible to rely for the warming of cars upon steam from the locomotive. It was said at the hearing before the railroad committee that complaints from passengers on the Boston and Albany of the temperature of the cars during the past winter were very loud and very frequent. It is notorious, too, that there was considerable suffering during the blizzard among the passengers on the Boston and Albany trains that were stalled between stations. And it may probably be safely asserted that while the Boston and Albany is endeavoring to make the system of heating recommended by the railroad commissioners a success, and will persevere until complete success or failure is assured, it would abandon the system altogether and at once if it were not for the expectation that continued experiments would result in greatly improving the particular method it has now in use. The result is that the opinion of the railroad commissioners, which they propose shall be carried into practical execution at such a very great cost to the railroads of the commonwealth, is really based upon nothing but the theoretical opinion of a professor of the Institute of Technology and the unfinished experiments of two railroads of the commonwealth.

"Mocha" Coffee.

The genuine Mocha coffee comes only from the province of Yemen, a province of Arabia, north of the Gulf of Aden, of which Mocha is the principal place on the sea coast. No coffee is grown in Mocha. We believe that something over 10,000 tons of coffee are annually exported from Mocha, but no small part of it is not the product of Yemen, but is grown in the East Indies and sent to Mocha, whence it is reshipped either as received or mixed with the Arabian product. Of the coffee sold under the name of Mocha, both in England and the United States, very little is grown in Yemen. Some comes from the East Indies, and other portions come from Africa, and even from Brazil. A British writer declares that not a kernel of the best Mocha coffee ever gets further west than Constantinople. All the best grains are picked out for use nearer home, and only the pale, shriveled, and broken seeds are left to reach any foreign shore.—*N. Y. Journal of Commerce.*

ALUMINUM is coming into use as a material for dental plates. It is nearly as light as rubber, but little more than one-eighth the weight of gold, has neither odor nor taste, is not affected by the elements of food or the secretions of the mouth, and costs, bulk for bulk, about one-sixth the present price of silver.

A Floating Sawmill.

One of the greatest novelties of a practical character which ingenuity has devised is thus described by a Florida newspaper: J. L. Maull & Son have their mammoth floating sawmill anchored off the banks of Burton & Harrison's hammock. This structure is a marvelous piece of mechanical ingenuity, and was built by J. W. Maull and Edward N. Maull. It is 80 × 40 feet, and stands about five feet out of the water, drawing only about 17 inches. It is solidly built, and according to the judgment of Mr. Carl, an old time ship builder, is capable of enduring the severe strains of even the waves of the ocean. The operation of all the machinery does not seem to move the vessel any more than if it was on the land. It has so far proved more of a success than its projector anticipated. It is equipped with a 40 horse power boiler and engine, with the latest improvements in saws and carriages. A planer, box head and shingle saws are all on deck and connected by shafting concealed under deck, so that the main deck is free from machines and available for the piling up of immense quantities of lumber. In one corner of the vessel is the cook house, where the hands board, while on the hurricane deck are the office and cabin of the proprietors and workmen. They are now so situated as to have command of an unlimited supply of the largest and finest timber, and from points heretofore practically inaccessible. A sawmill capable of moving up and down stream seeking a supply of logs, and thus bringing the mill to the product instead of *vice versa*, may offer very valuable advantages, especially in the South.

The Kaiser and the Steam Hammer.

The emperor displayed great interest in the working of the steam hammer, and Herr Krupp took the opportunity of speaking in high praise of the workman who had special charge of it. "Ackermann has a sure eye," he said, "and can stop the falling hammer at any moment. A hand might be placed on the anvil without fear, and he would stop the hammer within a hair's breadth of it."

"Let us try," said the emperor, "but not with a human hand—try my watch;" and he laid it, a splendid specimen of work, richly set with brilliants, on the anvil. Down came the immense mass of steel, and Ackermann, with his hand on the lever, stopped it just the sixth of an inch from the watch.

When he went to hand it back, the emperor replied, kindly: "No, Ackermann. Keep the watch in memory of an interesting moment."

The workman, embarrassed, stood with outstretched hand, not knowing what to do. Krupp came forward and took the watch, saying: "I'll keep it for you if you are afraid to take it from his Majesty."

A few minutes later they again passed the spot, and Krupp said: "Now you can take the emperor's present from my hand," and handed Ackermann the watch, wrapped up in a one thousand mark note.

A Long Tunnel.

A contract has been entered into between the board of direction of the Valley of Mexico and Mr. J. Gladwyn Jebb, representing the London-Mexican Prospecting and Finance Company, limited, for the execution of the work known as the Toquixquiac Tunnel. The work is to cost $2,350,000, covered by 7 per cent city bonds, issued at 82½ and running for at least ten years, the ultimate period of liquidation being fixed at thirty years. A sinking fund of 1 per cent per annum on the total issue is provided for. The limit fixed for the completion of the work is two and a half years, counting from the date of the formal transfer of the tunnel to the company, but practically three years are allowed, as it is stated that each day over three years employed by the company on the work shall cause a fine of $300 to be deducted from the amount due the company on final liquidation. On the other hand, for each day less than two and a half years saved by the company, a premium of $300 shall be awarded them. It is distinctly stipulated that the money raised by the emission of the bonds shall be devoted exclusively to the tunnel. The total length of the tunnel is 9·520 miles, of which there is already completed a trifle less than 1 mile. There are to be 23 shafts, of which 5 are already sunk. The tunnel will be brick lined throughout, with an inner cement coating, and the stipulations of the tunnel contract call for first class work.—*N. Y. Evening Post.*

PORTABLE MAGIC LANTERN.

T. O'CONOR SLOANE, PH.D.

A very compact form of magic lantern is illustrated in the cuts accompanying this article. It is adapted for all experimental purposes, as well as for the projection of views. The best way to give a correct idea will be to take, as example, a 4½ inch condenser lantern, and give the dimensions of the different parts, as shown in the cut. The size of the condensers settles the question of the measurements of the other parts.

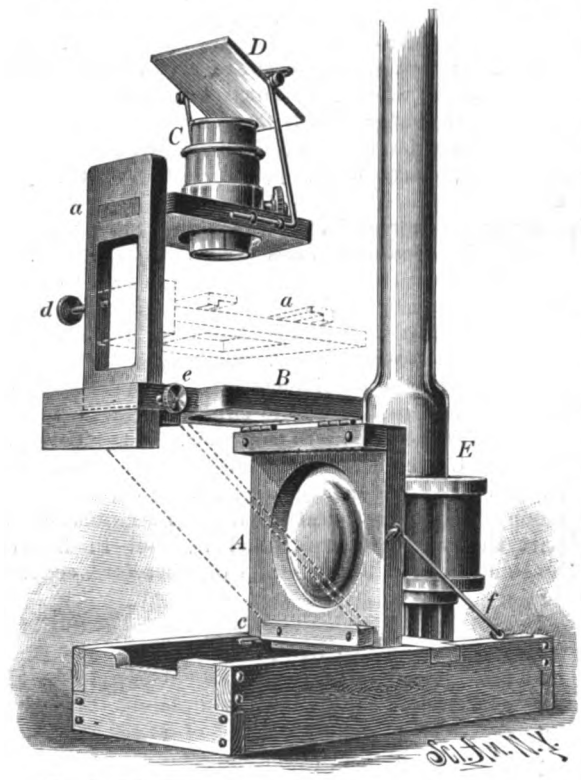


Fig. 3.—LANTERN ARRANGED FOR VERTICAL PROJECTION.

The two condenser lenses, plano-convex, are mounted each in a separate board. A circle is turned out with a rabbet in each board, in which the condenser seats itself, and is secured therein by three buttons. The rear condenser board, A, is 6¾ inches square. The front board, B, is of the same width, but 8¼ inches long. To the rear one a strip is screwed across the top edge, and the front one is hinged to this strip. At their bases, coming between them, two small abutting strips are secured. The thickness of the strips is such that the boards, when brought together, with the strips in contact, are strictly parallel, and the lenses are held apart from each other.

The frame or base of the lantern is a three-sided square, a little over 6¾ inches across, and 13 inches long in internal measurement. It is closed at the front and open at the back of the lantern. It is 2½ inches deep; 7½ inches from its front, the back condenser board is hinged to a strip that runs across the top of the frame, and is screwed firmly thereto, flush with its upper surface. A long brass hook, *f*, and staple is provided, for holding the condensers in place when vertical. The boards are held together, when desired, by another shorter hook, *c*, with staple. The condensers are then in place for horizontal projection. To arrange them for vertical projection, the small hook, *c*, is unfastened, the front condenser, B, is pushed up until the two are at an angle of 90°, and a plane mirror is inserted, resting against the two bottom strips. The mirror should be mounted on a thin board or on a brass plate, so as to provide strength and protect its back.

A mortise is cut in the front condenser 6¾ inches from its top, ⅝ inch wide and 3⅛ inches long. A piece of board, *a*, is cut to slide smoothly back and forward through this mortise. For retaining the strip in any desired place, a hand screw, *e*, is placed on the side of the condenser board, which is notched at both its lower corners. A strip of brass is attached to the side of this strip for the screw to press against.

The strip carries the slide carrier, *b*, and lens, C. The lens is attached to a board about 4 inches wide and 5½ high, with a tenon projecting from its base. A mortise is cut near the end of the sliding strip to receive this tenon.

A second mortise or slot, 4⅛ inches long and 2 inches wide, is made in the strip, *a*. The slide carrier, *b*, is a board 6½ inches high by 4½ inches wide. To its base is attached a piece of wood 3 inches square. This is ½ inch thick, and below it is a second piece of the same length, but just 2 inches wide. The second piece enters the slot in the sliding strip, *a*, and the slide carrier rests upon the shoulders formed by the upper block. A hand screw, *d*, is arranged to hold the slide carrier in place where desired.

A smaller movable mirror, D, is supplied, to be supported above the objective when the lantern is to be used for vertical projection.

A piece of sheet iron is fastened across the bottom of the main frame, on which the lantern, E, rests. In the front of the same frame a notch is cut in which the piece, *a*, rests. To make its position in the front condenser board more secure, a second strip may be attached just below the mortise and to the back of the board.

For lantern any good form of screened lamp may be used. If necessary, a sheet iron box may be arranged to inclose the source of light. But with such a lantern as is here shown it is quite unnecessary.

In the drawings, Fig. 1 shows the whole ready for mounting, the lamp being lighted and ready for work. The lamp should always be lighted before beginning, as it may take five minutes for it to attain its full power. Fig. 2 shows the whole put together and arranged for exhibiting views. By removing the slide carrier the entire space between condenser and objective is free for the introduction of apparatus or performance of experiments. A soap bubble can be blown and projected in this space. A glass of water can be very prettily shown, and the lantern will be found admirably adapted for the experimenter's use. Fig. 3 shows the lantern arranged for vertical projection, the outline of the mirror being given in dotted lines. As the slide carrier is not always used for work in this position, it, too, is shown in dotted lines.

If all is properly constructed, the apparatus will be susceptible of all kinds of adjustments. The sliding board, *a*, can be moved back and forth in the mortise in the front condenser board. The slide carrier can also be moved backward and forward. By these two adjustments the slide carrier can be brought to any point desired in the cone of rays converging from the condensers. By moving the lantern backward and forward, any modification in the direction of the light rays emerging from the condenser can be given.

A lime light can be used instead of an oil lamp. But as the object was to show a portable lantern, the former has been shown in the cuts.

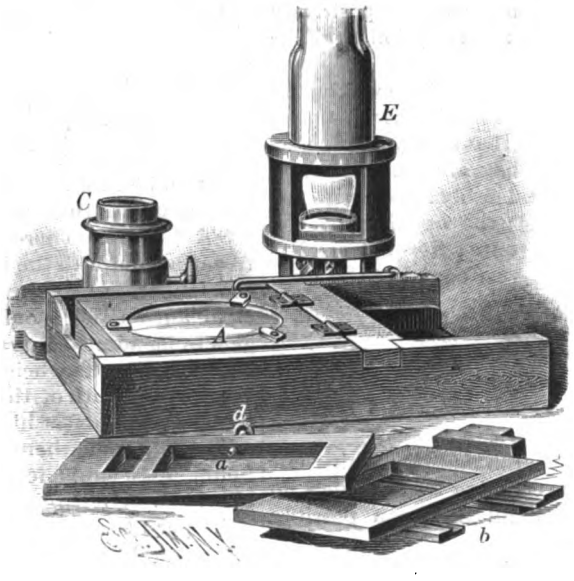


Fig. 1.—PORTABLE LANTERN TAKEN APART.

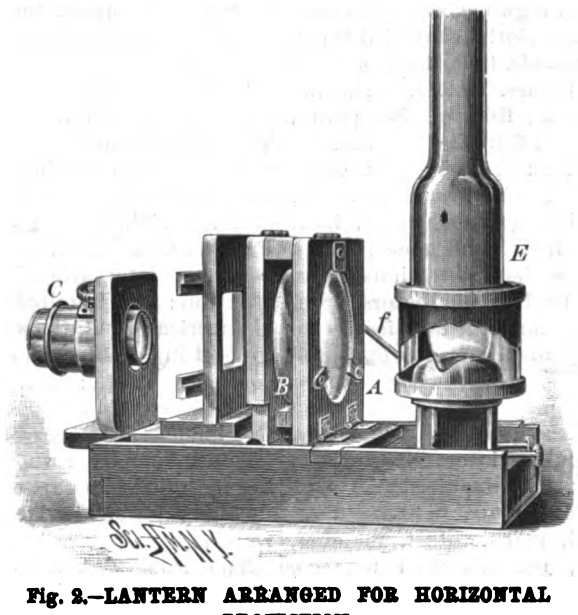


Fig. 2.—LANTERN ARRANGED FOR HORIZONTAL PROJECTION.

The Water Jet Telephone Transmitter.

This transmitter has been recently exhibited in England, where it has attracted attention, both by its novelty and its excellent performance as a long distance transmitter. The following is an abstract from a lecture recently delivered by Mr. G. W. De Tunzeemann: "The jet transmitter consists of a small jet of water, acidulated to render it a conductor, falling upon two electrodes, consisting respectively of a platinum wire and a platinum ring concentric with the wire and separated from it by a ring of glass or ebonite. The connection between the electrodes is formed by the nappe of the jet; and, when the jet is thrown into vibration by the sound of the voice, the variation of resistance between the electrodes causes it to act as a transmitter of great delicacy. This delicacy is so great that the voice of a person speaking in an ordinary tone at a distance of fifteen or twenty feet from the instrument is reproduced in a distant telephone with the most perfect distinctness."

In our issue of June 2 we copied some striking passages from a recent lecture of Prof. Elisha Gray on the "Progress of Electrical Science." The lecture quoted from was the first of a series before the Lake Forest (Ill.) University.

Trade of South America.

Among the recent consular reports issued by the State Department is an able paper on the above subject, by John E. Bacon, U. S. Consul at Monte Video, from which we make the following abstracts:

The unusual and energetic efforts on the part of Spain to recover the trade of her palmy days with South America, as also with the West Indies, Mexico, etc., are attracting great attention here, and are much commented upon in mercantile and diplomatic circles. Not less so are the efforts, still more energetic and successful, on the part of Germany to secure her share of the $700,000,000 of annual commerce (exports and imports) of the twenty "American Indias." In connection with these efforts comes the query, Why is the United States, especially so far as South America proper is concerned, so lacking in energy?

The countries south of the United States, consisting of the empire of Brazil, four European colonies, and fifteen republics, consist of over 40,000,000 people and have an aggregate area of over 8,500,000 square miles—a population almost equal and an area double that of the United States.

Their principal products are sugar, coffee, cocoa, fibrous plants, hard woods, cochineal, dye stuffs, and immense herds and flocks, furnishing countless hides and quantities of wool, all of which are greatly needed by the United States, and in return for which they should receive the innumerable articles manufactured from cotton, iron and other hard metals, agricultural and mechanical implements, shoes, hats, watches, and as they have no factories of their own worth the name, the countless articles formed and fashioned in the United States by the skill and invention peculiar to that country, and also wheat, corn, flour, bacon, tobacco, kerosene, oil, etc.

Of what, in detail, does this trade consist, especially the imports? The statistics of Spain alone, since her late effort to increase her trade, as above stated, prove that in many manufactured articles alone, supplied in this South American commerce, the variety is astounding, the principal (in 1886–87) being as follows: Agricultural and mechanical implements of all sorts, plows, hoes, reapers, thrashers, rakes, cars, wheels, axes, spades, shovels, etc., going to make up the interminable list of such implements and machines, and also the still more innumerable manufactures of cotton, woolen, and linen goods. Also arms, alcohol, apples, air guns, asbestos, axle grease, asphalt, acids, ash, art supplies, ammonia, buttons, billiard cloths, brass, bottles, butter, blacking, bran, beef, bananas, bells, blocks, bitters, brooms, bags, books, bacon, brushes, beans, bellows, bread, belting, beer, bicycles, brimstone, batteries, baby carriages, burial cases, britannia ware, bronzes, bustles, billiard tables, barks, borax, bath tubs, beeswax, bungs, candles, cinnamon, casters, cloves, chromos, corn meal, celluloid goods, cassia, crayons, corn starch, cigars, cigarettes, cages, cotton seed hulls, china, corn plant, carriages, carriage materials, collars, corsets, clothing, caustic soda, clay, caustic potash, candy-cement, cod sounds, candy, corn, car materials, carbons, corks, canary seed, coloring, cuspadores, cutlery, cocoa, clocks, cattle, cane chairs, codfish, canned goods, cucumber seed, crucibles, cheese, chalk, cyclostyles, cigar maker's boards, and all sorts of carriages, dental engines, druggist's ware, dates, dried fruits, dental instruments, drugs, dried fish, domestics, dry goods, eye glasses, extract logwood, engines, essential oils, empty shells, emery cloth, enameled duck, electric light material, fancy cards, fans, flint, feathers, feed, felt, fishing hooks and lines, frames, furniture, fire arms, flour, feather dusters, fish, figs, fish plates, fuse, fire crackers, fruit presses, fish oil, furs, files, gas fixtures, grindstone fixtures, guns, glass tubes, glass, glasses, gum senegal, gasoline, grindstones, groceries, glue, garlic, grease, hemp, hektographs, horns, hair, heading harness, handles, household goods, hides, hoops, hay, handcarts, hams, hardware, hats, hops, hose, igniting tapes, India rubber, incubators, iron, iron bars, iron tubes, iron manufactures, ice cream freezers, iron safes, ink, japanned ware, jute, jewelry, lamps and lamp fixtures, etc., leather, leather belting, leather fixings and manufactures, lightning rods, lubricating oil, lathes, lead pencils, leather bags, locomotives, labels, lard, lumber, locomotive springs, linseed oil, lime, machinery, manufactured zinc, matting, minerals, match splints, mats, maizena, mattresses, manufactured wood, marble dust, matches, music, manufactured hair, manufactured tobacco, Mexican silver, machine oil, mince meat, mast hoops, moulds, metallic shells, mineral waters, needles, newspapers, notions, nuts, nails, organs, oak, oakum, oil cake, oats, oatmeal, onions, olive oil, oars, organettes, olives, paper, paper hangings, etc., printing type and material, patent leather, post office boxes, pop corn, paraffine oil, porcelain ware, pickles, pianos, pins, pimento, percussion caps, pork, peas, pumps, pumice stone, pictures, pickled fish, perfumery, pitch, pencils, pepper, potatoes, paint, photographic material, paper, petroleum, plaster, plated ware, rice, resin, raisins, rivets, railroad spikes, refrigerators, resin oil, railroad fixtures, rubber belts, revolvers, railroad cars, shafts, spikes, stove polish, sausages, staples, syringes, saw teeth, smoothing boards, sarsaparilla, soap grease, shot, shell primers, salves, sand, steel rails, saws, sickles, straw goods, scientific instruments, sponges, spirits turpentine, strawboard, starch, soap, paste, scissors, sewing machines, snuff, silex, saddlery, specie, scales, sugar, sandpaper, sperm oil, silver ware, shoes, shooks and heads, slates, stationery, shawls, straps, sulphur, sheet iron, twine, tin, tents, tags, tiles, telephones, tongues, tarpaulins, tin foil, toilet ware, tea, toys, trunks, telegraph material, tools, tallow, trucks, tar, tobacco, toothpicks, tacks, tinware, thread, tallow scraps, toilet sets, type writers, valves, velocipedes, vegetables, varnish, vermicelli, vermouth, wood, wheat, window glass, woodware, wood manufactures, whips, wines, wheels, walnut, watches, wheelbarrows, whitewood, water wheels, water colors, wall paper, whiting, wooden pails, wood sticks, wire, wire screws, windmills, wax, wads, yellow ocher, yarn, yeast, zinc.

If the commerce of a third or fourth rate commercial country like Spain discloses such a list of articles, how countless must they be when regard is had to that of England, France, Germany, the United States, etc.!

It is evident this South American trade is worth having, and deserves a serious struggle, and, as above intimated, the best evidence of its value is shown by the continued and energetic efforts on the part of the great maritime powers to control it. It is also evident that the United States, if she will make a serious effort, exhibit half the energy, and invest one-fourth the money that these countries do, can secure the better part thereof. She controlled it, and in her own bottoms, before the war, and can, therefore, control it again.

In 1856 United States vessels conveyed (exports and imports) from and to her ports, in value, $483,368,274, and foreign vessels only $159,336,176. In 1886, thirty years later, the tables were completely turned, and foreign vessels conveyed a value of $1,139,636,971, and United States bottoms, $227,947,500.

England, France, Germany, and Spain have found that trained, intelligent, and energetic consuls are required at every port, that long credit at a small rate of interest is necessary, and that great pains in the packing and dispatching of goods, prompt dealings, reliable exactness in business, a proper catering to the habits and tastes of the purchasers, great energy, and sleepless vigilance, together with commercial treaties with all states, and an abolition, if possible, of all duties upon the raw productions of South America, are likewise required. A strict conformity to these requirements has enabled Germany within the past five years to compete successfully, in fact, to supersede, in many instances, her able and influential rivals in a commerce which, up to that time, they had monopolized, especially England.

The journals of France and Spain are also greatly concerned as to this German ascendency. On the contrary, none of the English, French, German, or Spanish papers seems to have the least fear of any interference with trade or commerce by the United States. Indeed, their articles in this regard are tinged with a mixture of ridicule and pity. Almost all of them concluded by stating, in substance, that the United States are not to be dreaded so long as they merely look forward to being able, within a few years, to control the entire Spanish-American trade, provided the proper means be adopted, but does not suggest positively what these means are or when the adoption shall be decreed.

"Our enterprising American cousins" are waking up to the great and increasing Spanish-American trade. They are figuring over the facts that nearly all of these countries are republics; that they are contiguous, on the same hemisphere, and considerably in love with the great, model, mother republic; the opening of the Panama Canal and Nicaragua route; New Orleans Exposition; international fairs; Centennial of the Constitution; four hundredth anniversary of the discovery of America; invitations to all Spanish-American states to meet in Washington or New York; South American commissions, etc.; as if such figuring by some novel Yankee invention in arithmetical rules would transfer this immense commerce to American shores.

The change from wooden to iron and steel ships cut her out of a large part of the carrying trade, which no fiscal regulations or lack of regulations can possibly restore.

The Buenos Ayres *Standard* says, among other things:

"Congress has created commissions who have gone junketing about the world with no end of fuss and feathers, making a loud noise, and doing nothing. . . . It seems to be the opinion of Americans that commercial relations are to be created by a series of resolutions and the visits of an itinerating commission, and that such old fashioned ways as the investment of capital and the doing of work are not necessary in the case of American enterprise. . . . No one need quarrel with the Americans about this, for they have every right to select the field of their operations. . . . So long as Europe comes here with its millions and Americans come here with itinerating commission, the business supremacy of Europe in this country will be seen."

Consul Bacon thinks the quickest and best way of securing South American trade is to continue the railway southward from Mexico. He says:

"Fortunately, the United States is not confined to the ocean in order to recover this immense South American commerce. An international railway would not only control, but monopolize it, and in such way as to defy all future competition.

"Within three years railroads have been actually built and routes surveyed for at least one-third of the distance between Buenos Ayres and Bogota. This leads me to believe the great international highway (railroad) will be completed much sooner than has been anticipated. These railways, together with shorter ones already in operation in Peru, Ecuador, and Bolivia, with which connections might be easily made, would make the distance between the two cities, Buenos Ayres and Bogota, to be filled up only about 2,000 miles. It is by no means so gigantic an undertaking as the great Pacific road, connecting the Atlantic and Pacific, over 3,000 miles. I allude to this to show how distance, time, obstacles, visionary impediments, sneer and ridicule vanish before concentrated determination, energy, capital, and skill.

Public Health.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. A. Marichal read a paper on the "Public Health of Cities and Towns," of which the following is an abstract:

Water Supply.—In many cities the water works are supplied neither with filters nor subsiding reservoir, and after a heavy rain the water contains clay powder, which is decidedly injurious, especially to children, causing inflammation of the bowels and other troubles, the cause of which is generally unknown, although thousands of people are affected.

If every property owner would consider a filter a no less essential part of a dwelling than a bath tub or a water closet, a supply of pure water would be enjoyed by the poor as well as by the rich, and without appreciable cost to any one.

Drainage.—The system of sewers should be such as not to allow any filthy matter to remain in them more than twelve hours. To obtain these results the sewers should have sufficient slopes and should be flushed every day. The flushing can be attended to by the police, consequently without extra cost for labor, and that by simply opening the fire plugs, thus *cleansing* the gutters and the inlets and accelerating the flow in the sewers.

Manholes should be made air tight. Ventilation pipes should be placed at the upper part of the sewer, should be extended under the pavement to the house line and thence carried above the roof of the buildings. These pipes need not be of large diameter, but should be numerous.

Cesspools should be strictly prohibited. It is well known that the germs of cholera are transmitted through the fæcal matters. In a city where cesspools are allowed, it would be impossible to control the ravages of the disease.

Paving.—The very first thing to be thought of in paving a street is to provide gutters with sufficient slopes. Belgian blocks placed lengthwise will make an effective gutter. The slope should be at least 0·5 per cent.

Inlets should not be more than 400 feet apart when streets are level. They should be made of cast iron and not of bricks.

Street Cleaning.—It should be done between midnight and 5 A.M., as it is unsafe to inhale all the dust accompanying this operation.

Street Cars.—There are, perhaps, few causes contributing more to the increase of the death rate than the deliberate overcrowding of the street cars. Municipal authorities should limit the number of passengers to be admitted on a car.

Dwellings.—The height of a building should never exceed the width of the street, and each story should be at least nine feet high.

In any room where persons have to spend several hours, 1,000 cubic feet of space per capita should be provided. Each room should have 20 square feet of light per 1,000 cubic feet of space, etc.

The Gold Mines of Manchuria.

The attention of the Chinese government having been directed to the gold fields in the Amour region by recent disorders there, a commission was appointed to examine and report on the best means of working these deposits. An official who was sent to the spot gives a doleful account of the desolation of the region in question and the difficulty of procuring food. The country, he says, is covered with snow in winter to the depth of 10 feet or 12 feet, and "in summer and autumn there is a species of insect which fills up people's noses, making life unbearable." There are no roads, and to supply military protection for the miners would be a serious matter.

Wanted, an Engineer.

W. H. WAKEMAN.

Wanted, an engineer, to run a stationary engine. Address X.

Whenever we see the above notice appear in the "want" column of a newspaper, or when it becomes known by any other means that a man will be needed for this purpose soon, it is sometimes surprising to see the number that will apply for the place, and to note the experience and capabilities of some of the applicants. One has been employed by a railroad company, and his duty has been to wipe up the locomotives after they have been run into the roundhouse. He has run them back and forth, a few yards at a time, as occasion demanded, and from the knowledge acquired here he feels that he is competent for the position, and can run any kind of engine, or do all repairs and care for an entire steam plant.

Another is called the "sub" in the shop where he is now employed, and one of his duties is to stay in the fireroom for an hour or two at a time, or perhaps to shovel coal and watch the pump for half a day occasionally during the absence of the engineer. Feels at home around an engine, and is satisfied that he can do the work. Will work for a low price.

Another has run an engine for four years or more, has a recommendation from his last employer, saying that he is a sober man, etc. He asks for a fair rate of compensation, but thinks that he can earn it.

Still another is one of those nice young men who alway wear a "boiled shirt" and stand-up collar. Some folks would call him a dude. He has read something about steam, and wants to be an engineer. The next one is a machinist by trade.

The next has been a fireman for several years. He has cleaned his boilers himself, understands the principles that cause his pumps to work, and when they refuse to deliver water, soon finds out the cause and applies a remedy. He starts and stops the engine during the absence of the engineer, and helps to wipe it up every night, and when any repairs are to be made on it, he is sure to be there, trying to learn all that he can about its construction. The last one is an industrious, competent engineer, and has been for years, but for reasons which he is not ashamed to give, he wishes to secure a situation where his services will be appreciated. He asks a fair price for his work and will take no less. Now let us follow the fortunes of these men, and see which of them succeed and which fail, for these are no fancy sketches, but refer to actual occurrences, as they all succeed in obtaining a situation, but, of course, in different places. Let us consider them in the order above named. The first gets along very well for a few weeks, as minor shortcomings are overlooked, until one day the engine, which is an automatic one, with the disengaging type of valve gear, refuses to run, and our man is in great tribulation. It is impossible for him to even locate the trouble, to say nothing of being able to remedy it, and as there is no engineer near to help him, and the shop must not be shut down any longer than is necessary, the proprietor sends to another city, about fifty miles distant, and secures the services of a consulting engineer, who comes, looks at the engine, takes a wrench, loosens a small set screw, moves one of the parts a fraction of an inch, and tightens the set screw again, when, "Eureka!" and the trouble is not only found, but it has also disappeared, and the engine is all ready for business again. As to the expense of the operation, the reader can estimate that for himself.

Our embryo engineer is now operating two implements that he seems to understand perfectly, namely, a pick and a shovel.

The one that had learned to be an engineer by running occasionally for another man found that the engine that he had taken charge of was different from the one that he was familiar with. It was of the automatic type, with a stop motion so arranged that whenever the governor balls were allowed to fall to their lowest position for any cause, the steam valves would not open, and the engine would soon stop for want of steam to run it.

Well, our friend was settling himself down and expecting to take some comfort, when one day the engine slowed down and finally stopped. He examined the throttle valve and found it wide open; there were no hot boxes to cause the stoppage, and to him there appeared to be no reason why it should not go. By this time the proprietor and a majority of the operatives were in the engine room inquiring what he had shut down for, and as it was one of those places where the power cannot be shut down (except at certain times) without causing serious loss, he was in a great deal of trouble, and regretted that he had enlisted.

And now ready hands seize the fly-wheel and main belt and turn the engine several times, with the throttle valve wide open, but when they cease their exertions, it goes no better than before. So the proprietor gets into his wagon and drives to another part of the city, and brings out an engineer, who looks at the engine for about fifteen seconds, closes the throttle valve, raises the governor balls up, and blocks them there with a piece of iron made for that purpose, hoops up the cut-off valves and gives steam, when the machinery starts slowly, and increases its speed as more steam is admitted, until all is again running smoothly; but the engineering days of the substitute are numbered, and an experienced runner succeeds him at thirty-three per cent more salary.

Let us now call on the engineer that has had four years' experience. It does not take a very long time to find out that he has run a throttling engine and understands no other, but he has charge of a new Harris-Corliss in this place. Everything is running smoothly now, but soon one of the crab claws refuses to "catch on," the engine runs slower and very unsteady, and it becomes necessary (so he thinks) to shut down.

He has not the least idea what to do, but soon a happy thought suggests itself, and seizing a wrench, he proceeds to loosen the jam nuts on the "right and left" connection between the steam valve and the wrist plate, and then lengthens it until the crab claw hooks on again, and concludes at once that he is a genius.

Soon the power is running at full speed, but why does it still run so unsteady? Our engineer thinks that he has discovered the cause. So, shutting down again, he attacks the valve gear for the second time with his wrench, and soon it is completely demoralized.

A few days afterward we saw a friend, who informed us that he left the shop one night, promising to report for duty the next day at 9 o'clock, but he has not been seen there since.

We next turn our attention to the dude engineer, and find that he is running a small horizontal engine and a vertical boiler, and as it is a very clean place, the work is light, and he has time to read stories, he appears satisfied. But after a time everything does not run as smoothly as it did once, and he has trouble with his plant, and cannot tell where it is, or what to do.

This is concealed from his employer for a little while, but at last it is too plain to be overlooked. He is found to be deficient, and told that his resignation will be thankfully received; and as no one cares to recommend him as a competent engineer, he soon finds employment in an entirely different business.

Some steam users appear to think that if a man has learned the machinists' trade, he must of necessity be an engineer.

Why this is so is not clear, any more than if a blacksmith should be expected to know how to shoe a horse, but it is so, and as this machinist applies for a certain engine to run, he is engaged at once. He knows enough to open the throttle valve and start the engine, but when he attempts to put on the steam to heat the shop, which is a medium sized one, with several different kinds of radiators and traps, he is at a loss to know what to do, and instead of tracing the pipes from the boiler through all of their windings and turns, until they terminate at the traps, he only learns from the man who is instructing him that when he comes in the morning he must open this valve and shut that one, etc., just as a monkey learns to do one trick after another when his master begins to play the hand organ, and with no clearer idea of what he is doing it for.

Soon there is complaint made that the shop is not heated as it should be, but as our machinist has played all of his tricks to no purpose, some one else is called upon to set matters right.

He notices that the engine pounds a little, and as he knows little or nothing of the steam engine, he thinks that it must be because there is lost motion somewhere, and proceeds to drive the key on the cross-head end of the connecting rod. Result: a hot box, a scored wrist pin, the engine has to be shut down three times in one day, and he is obliged at last to put the key back where it was before and to try something else. But before he gets the pound out he is informed that his services are no longer required, and he gathers together his tools and takes his departure, giving vent to his wrath in such language as is seldom seen in print, and which we will omit here.

As to the two last ones, no one will be surprised to learn that they run their plants economically and well, that their engines start up on time, and are not shut down through any fault of theirs until the proper time at noon or night, that everything is neat and clean in their engine and fire rooms, that they give their employers satisfaction, and are considered valuable men.

These are days of close competition and small profits in many kinds of business, and it will make a great difference whether a competent man is in the engine room or a man who does not thoroughly understand his business, or what is much worse, a man who does not have the interest of his employer at heart.

You cannot buy gold dollars for seventy-five cents; and many a competent engineer has resigned his position, not because he could not get fair wages, but on account of the contemptible policy persisted in by his employers in the management of shop affairs.—*Manfrs. Gazette.*

THE largest collection of coins, 125,000 in number, is in the cabinet of antiquities, Vienna.

Improved Railway Appliances Greatly Needed.

The railroad commissioners of the State of New York report that during the year ending September 30, 1887, there were 199 railroad employes killed and 896 more or less severely injured in the performance of their duties. These accidents are classified as follows:

	Killed.	Injured.
Fell from train, engine, or cars, or getting on or off trains	48	162
Striking low bridges, switches, tunnels, etc	8	9
Coupling or uncoupling cars	20	437
Walking or being on track	102	88
Catching foot in frog or between rails	4	7
Derailment	1	19
Collisions	6	40
Other causes	10	144
Total	199	896

According to "Poor's Manual," the number of locomotives owned by railroads in the State of New York in 1886 was 2,722, and in the whole country 26,415. It will be quite safe to say that there were ten times as many locomotives in the whole country as there were in New York during the period covered by the railroad commissioners' report. If the average number of persons killed or injured per locomotive is the same elsewhere, the number of casualties to railroad employes in the whole country would be ten times the above figures, or a total in round numbers of 2,000 killed and 9,000 injured.

No pretense is made that this estimate gives the number of employes killed and injured with anything more than an approximation to accuracy. It must be remembered, though, that whatever errors there may be in the reports of accidents to the railroad commissioners, and of the number of locomotives in the country, are errors of omission, and that probably both the number of accidents and of locomotives are greater than reported, which would make the above estimate too low, rather than too high. Nevertheless, with any reasonable deduction, the record of frightful suffering, pain, and sorrow will be more than sufficient to emphasize the following inquiries, the aim of which is to elicit information that will indicate how the number of such accidents may be diminished.

All railroad officers and employes, whether members of the Master Car Builders' Association or not, are therefore requested by the committee of the association to send answers to the following questions to M. N. Forney, 145 Broadway, New York:

1. What defects are there in the present construction of cars and locomotives which cause accidents to railroad employes by falling from trains, engines, or cars, or of accidents of getting on or off trains?

2. What changes could be made in cars or locomotives which would diminish the number of such accidents?

3. What kind of couplers and dead-blocks are the most dangerous to employes in coupling cars?

4. What kind of couplers and dead-blocks do you think are the least dangerous to employes?

5. Has the introduction of automatic couplers thus far lessened the danger of coupling cars?

6. Would the general introduction of automatic couplers, in your opinion, diminish the danger of coupling cars?

7. Can you suggest any way of lessening the number of accidents to employes from "walking or being on the track"?

8. How can employes be prevented from "catching their feet in frogs or between rails"?

9. In what way may any other kinds of accidents to employes be prevented or the number lessened?

All railway officers and employes who see this circular are earnestly solicited to answer it, and thus add the weight of their testimony in helping to reduce the terrible sacrifice of life and limb which is annually exacted from our railroad employes.

Great Chances for Three Inventors.

Prof. R. H. Thurston, in the May *Forum*, states that the world is awaiting the appearance of three inventors, greater than any who have gone before, and to whom it will accord honors and emoluments far exceeding all ever yet received by any of their predecessors. The first is he who will show us how, by the combustion of fuel, directly to produce the electric current; the second is the man who will teach us to reproduce the beautiful light of the glow worm and the firefly, a light without heat, the production of which means the utilization of energy without that still more serious waste than the thermo-dynamic now met with in the attempt to produce light; while the third is the inventor who is to give us the first practically successful air ship. The first two of these problems are set for the electrical engineer, and we may be pardoned excess of faith, should it prove to be such, when, contemplating the enormous gain to humanity which must come of such inventions, we look confidently for the genius who is to multiply the wealth of the world to an extent beside which even the boon conferred by the creators of the steam engine and the telegraph will not appear overshadowing. When this inventor comes forward, and most probably not till then, it is very likely that we shall see steam superseded by a rival.

ENGINEERING INVENTIONS.

A triple valve for air brakes has been patented by Mr. George B. Williams, of La Crosse, Wis. This invention covers a novel combination and arrangement of parts whereby the brakes may be applied simultaneously at the front, rear, and middle of a train, or may be applied sooner and with greater force on special cars in the train.

A valve gear has been patented by Mr. Robert Mackay, of Warren, Pa. Combined with a link is an upwardly extending rod, an operating lever, a swivel eye, and stops carried by the upwardly extending rod upon either side of the swivel eye, with other novel features, the design being to steady the position of the link, and to provide for its quick and ready adjustment.

A rotary valve has been patented by Mr. James O'Donnell, of San Francisco, Cal. It is a cylindrical oscillating valve, with two ports connecting alternately the steam supply with the ports leading to the cylinder, the valve having also an external cavity in its rim connecting the exhaust port alternately with the ports leading to the cylinder, the valve being simple, perfectly balanced, and dispensing with the usual steam chest.

AGRICULTURAL INVENTION.

A cleaner and gauge attachment for grain drills has been patented by Mr. John T. West, of Bowling Green, Ky. It is a rotary and vertically adjustable attachment designed to prevent the accumulation of trash in the form of grass, weeds, stubble, etc., and regulate the depth of the furrows made by the teeth or flukes, and thus facilitate the work of grain drills.

MISCELLANEOUS INVENTIONS.

A folding cot has been patented by Mr. John C. Porter, of New York City. Its cross pieces support coiled springs which support slats, while folding legs are pivoted to the side pieces, the construction being cheap, strong and practical, and the cot occupying but little space when folded.

A machine for excavating has been patented by Mr. Charles S. Jones, of Yates Center, Kansas. This invention covers a novel construction and combination of parts for an improved scavenger by which privy vaults can be conveniently emptied of their contents and the latter transported to any desired place.

A grindstone hanger has been patented by Mr. Dennis O'Leary, of San Bernardino, Cal. The invention consists of a split shaft supporting the stone, washers held on the shaft, and a nut screwing against one of the washers, while a key presses against the other washer to hold the stone securely in place on the shaft.

A strap edging machine has been patented by Mr. James N. Farlow, of Lander, Wyoming Ter. Combined with a frame having fixed and movable cutters, and a sliding clamp having similar cutters, is a tilting presser bar or lever adapted to bear upon the movable cutters, the machine being designed for beveling the edges of leather straps.

A screw driver attachment has been patented by Mr. Lee Kiblinger, of Jackson, La. The blade is provided with a lateral catch or projection, and a slide is fitted to the blade carrying a point or awl to make a hole for the screw, the slide being adapted to be engaged by the catch while in the position of use.

A wire fence has been patented by Mr. Jesse J. Buchanan, of Bridgeport, Ill. It is made with horizontal fence wires in combination with a hollow metallic post, through perforations in which are passed wire fasteners, bent and twisted to hold the fence wires in position, the post having also a heavy tile base.

A bottle filler has been patented by Mr. William H. Comstock, of Oskaloosa, Iowa. This invention covers novel parts and details in a device whereby bottles may be filled so that the liquid will not come in contact with the outside air, and with which both light and heavy bottles will be evenly filled without waste of the liquid.

A shaft coupling has been patented by Mr. Simon H. Barnes, of Lanesborough, Pa. It is made with a longitudinally split sleeve whose parts act as clamps or compressors to grip the meeting end portions of shaft sections to couple and hold them in line, the sleeve being inclosed by a tightening and loosening band.

A commode has been patented by Messrs. Gayger D. Tolman and Lorenzo D. Roberts, of Shawano, Wis. It is designed to be simple in construction and very compact, while furnishing various conveniences used in dressing, the invention covering a novel construction, combination, and arrangement of parts.

A drapery hook has been patented by Messrs. Ralph Tilton, of New York City, and Martin Cowen, of Chicago, Ill. It is a suspension hook made of a piece of spring metal bent into a staple and hook-like form, to be used in combination with a sliding drapery or curtain ring having an eye adapted to receive the spring prongs of the hook.

A rack for exhibiting goods has been patented by Messrs. Adolph Neuville, of St. Louis, Mo., and Albert Back, of New York City. This invention covers a novel construction, combination, and arrangement of parts, providing a device designed to be used in dry goods stores, whereby lace curtains and other goods may be exhibited to customers to advantage.

A breaker and crusher has been patented by Mr. Frederick L. Preston, of Darien, Wis. It has a fixed corrugated jaw and fixed side plates, with an inclined pivoted vibrating jaw in combination with a pushing plate, and other novel features, making a simple, durable, and effective machine for breaking and crushing rocks, ores, etc.

A track lifter has been patented by Mr. Gavin Rainnie, of Portland, New Brunswick, Canada. It has a lever and ratchet arrangement in connection with a cast iron frame about sixteen inches high, with an extended base plate, being designed to hold itself in position when the rails and sleepers are lifted, thus saving the time and labor of track repairers.

An anti-friction bearing has been patented by Frank Corbett, of New York City. It is of that class in which a nest of bearing rollers are mounted to revolve in a chambered box, and provides for the ready introduction and removal of the rollers, being particularly adapted for ironing machines where the rollers are hollow and heated by steam.

A broiling oven for ranges has been patented by Mr. James G. Lyon, of Brooklyn, N. Y. The fire pot of the range is provided with an open front grate set back from the front of the range, and the space between the fire pot and the range front is floored over, forming a space in which viands may be exposed to the live coals behind the front grate.

A fire escape has been patented by Mr. John Grant, of Beverly, Mass. It is a portable device which may be readily secured to a window, the invention covering a novel construction by which the descent of an occupant may be controlled from the window or street, accommodations being also provided for lowering an infant or disabled person with safety.

A type writing machine has been patented by Mr. George L. Ferris, of St. Louis, Mo. This invention covers an improvement in that class of machines in which a vertically and laterally swinging hand lever operates a printing type wheel and paper feeding mechanism, being designed to simplify the construction and give increased ease and rapidity of operation.

A horse detacher has been patented by Messrs. Walter L. and Philip M. Mitzel and John Q. A. Haney, of Felton, Pa. The detaching devices are applied to the whiffletree, the ends of which are provided with spring-seated locking bolts that pass through the trace eyes and are operated from the vehicle to release the traces, whereby the horse may be detached from the vehicle.

A loading apparatus for ordnance cartridges has been patented by Mr. John T. Jefferson, of Annapolis, Md. It is for use with that form of cartridge which is built up from moulded blocks or cubes of powder having a central perforation, and is designed to enable such a cartridge to be built by one man in one-fourth the time required by two men in the old way, while a smaller bag may be used.

A Venetian blind has been patented by Mr. Samuel S. Patterson, of Wilkesbarre, Pa. This invention covers a novel construction and combination of parts, including the slats and side pieces, providing that when the rolling slats are closed the blind will effectually exclude the sun or rays of light, the slats having a closer joint and neater finish than heretofore employed in these blinds.

A hame has been patented by Mr. James N. Farlow, of Lander, Wyoming Ter. The invention consists in forming the hame with notches, and combining therewith a sliding clip with notches, a bolt or fastening for the hame tug, and a screw and nut to close the teeth of the clip into the teeth of the hame, to facilitate adjustment for raising and lowering the draught.

An artificial leg has been patented by Mr. Alexander Gault, of Medford, Minn. It has a socket for receiving the stump of an amputated leg, formed and suitably shaped of hard moulded India rubber or gutta percha, with other novel features, being especially adapted for use by one whose leg has been amputated between the knee and foot, and designed not to chafe the stump of the wearer.

A head block for saw mills has been patented by Mr. Irwin Swank, of Paris, Ill. This invention covers a novel construction, combination, and arrangement of parts to insure increased efficiency in machinery of this class, the improvement being applicable in the sawing of slab sides and tapering boards or planks, and the turning or rolling of logs on the knees therefor.

A drying attachment for tobacco barns has been patented by Mr. John M. Snidow, of Big Stony Creek, Va. It consists of a furnace with two dampers below the combustion chamber, and having a cold air pipe connected thereto between the dampers, whereby tobacco barns can be kept at the temperature at which tobacco is cured with the best results and in the least time.

A boom fastening has been patented by Mr. John H. Rushton, of Canton, N. Y. It is intended to take the place of the jaw on small craft, and for supporting sails extending past the mast, or from the mast aft, and consists of a ring to be received on the mast, with ears projecting from one side, a swiveled clamp for receiving the boom, and a spike to be driven into the boom where it extends from the mast aft.

A spokeshave has been patented by Messrs. James H. and Benjamin F. Polhemus, of Brooklyn, N. Y. This invention covers an improvement on a former patented invention of the same inventors, its object being to provide a tool capable of use as readily in curves of small radius as upon a flat surface, the invention also making a further improvement in the construction of the tool.

A tile machine has been patented by Messrs. Emil Puchta and Robert Hoffmann, of Washington, Mo. This invention covers a mould press of novel form, combined with a movable former, for moulding and pressing bottles, jars, and other articles with closed bottoms, out of clay or analogous substances, and has for its object to facilitate the removal of the completed article from the press.

A receptacle and heater for tea, coffee, milk, etc., has been patented by Mr. Charles W. Hellenbrand, of Salem, Oregon. It consists of three superposed tanks or jars, the lower one to contain hot water, and having a lamp or gas jet beneath it, the intermediate jar, resting thereon, to receive milk, and the top jar for coffee, etc., a pipe from this jar leading through a coil in the hot water jar or tank to a cock at the bottom.

A pool registering device has been patented by Mr. Charles S. Krafft, of Albany, N. Y. It is constructed with a lock for holding the triangle, the lock being connected with a mechanism arranged to register the detachment of the triangle upon a dial, strike a gong, and at the same time drop a check into a box, the register being adapted for connection with a distant bell by an electric circuit on the detachment of the triangle from the lock.

A wheel has been patented by Mr. Henry Q. Maurino, of Albuquerque, New Mexico. The hub block consists of a casting having grooves or slots for the inner bifurcated ends of the spoke, while the felly has a polygonal inner face, with angles corresponding to the number of spokes and their angular outer ends, with other novel features, the construction being designed to secure cheapness, lightness, and durability.

A school slate and ruler therefor has been patented by Maybury W. Fleming, of New Brighton, N. Y., and Charles R. Le Sauvage, of Brooklyn, N. Y. The slate frame has grooves in its inner edges above the surface of the slate, combined with a ruler having rabbeted ends adapted to slide in the grooves, with a centrally recessed under surface whereby a bearing surface is provided at the ends only, making a straight edge or ruler which may be moved over the surface of the slate.

Business and Personal.

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

NEW BOOKS AND PUBLICATIONS.

LOCKWOOD'S DICTIONARY OF TERMS USED IN MECHANICAL ENGINEERING. London: Crosby, Lockwood & Son. Pp. 417. Price $3.

This work does not assume to be a general reference book for terms used in all mechanical branches, but only for such as are directly connected with the practice of engineering, as in the drawing department, pattern shop, and foundry, in the fitting, turning, and smith's shops, and in all kinds of boiler work. The definitions cover some six thousand terms, embracing those in most common use in the workshop, as well as a vast number of technical terms of comparatively recent origin in the science of modern engineering.

PHOTOGRAPHY APPLIED TO SURVEYING. By Lieut. Henry A. Reed, U. S. A. New York: John Wiley & Sons. 68 pp. quarto, with illustrations. Price $2.50.

The author claims that, in themselves, photographs present all the data necessary for the construction of an accurate map, thus rendering other field work unnecessary, while at present photographs are only used in the United States as an addenda to the field work. In France, however, photography has been more generally applied to surveying, with a great saving of time and labor. The subject is presented by the author in a plain and concise manner, according to the experience obtained in his own practice, and with reference to the contributions of numerous foreign writers.

THE WATCH JOBBER'S HANDYBOOK. London: Crosby, Lockwood & Co. Pp. 144. Price 80 cents.

THE WOOD TURNER'S HANDYBOOK. London: Crosby, Lockwood & Co. Pp. 144. Price 80 cents.

These manuals are of a series of handybooks for handicrafts, the first object in all of which is to be practical and elementary, so that they will be of valuable assistance to an apprentice just commencing to learn a trade in either of the departments to which they relate, or to an amateur seeking to do such work for himself. They are very plain and minute in their descriptions of tools and how to use them, are fully illustrated, and afford sufficient information to enable a young man or boy having any facility at mechanical work to do a great many jobs such as would ordinarily be sent to a regular craftsman.

☞ Any of the above books may be purchased through this office. Send for new catalogue just published. Address MUNN & Co., 361 Broadway, New York.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) T. W. V. asks: What is the best kind of material to make cores for steel castings? Cores used for cast iron do not do very well for steel, as the steel being much hotter than cast iron, cuts into the cores and leaves a rough casting. A. Try ground fire brick with the dust blown out. Make the cores in the same way as with sand.

(2) T. G. R. writes: 1. T. H. claims to have a hydrometer which, when suspended in a silver or gold solution, will denote the quantity of metal in said solution. Is there any such hydrometer? I have Baume's hydrometer, but I cannot tell the quantity of metal in a solution with that, and I find, by inquiry, it (Baume's) is generally used by platers around here. A. All hydrometers are based on the same general principle, and usually differ only in graduation. They will not indicate the amount of gold or silver in a plating solution with any approach to accuracy. 2. Silver plated ware is advertised as single, double, triple, and quadruple plate, now what is the definition of above terms. Is there a given weight of the metal deposited on a given surface to denote each term? A. As used in this country, they are simply arbitrary terms, not denoting absolute, but only comparative weight of metal deposited, the double plate of some manufacturers equaling the triple plate of others, etc. 3. What is the weight of a gramme in Troy weight? A. A gramme is equal to 15·43235 grains. 4. In a great many mechanical as well as electrical calculations I meet with, letters are used which I cannot understand. How are such calculations made? A. You will have to study the subject of electricity from the beginning. We recommend Watt's Electro-Deposition, which we can send you by mail for $3.50.

(3) H. G. H. writes: 1. At sunset we see a band of stratus clouds in the west, seeming to rest upon the horizon. How far distant from the point of observation is the place where those clouds are directly overhead? A. Stratus clouds are variable in height. Generally low in winter and higher in summer. Their height may be from 800 to 5,000 feet. Clouds 800 feet high may be seen on the horizon at 36 miles distance. At 2,000 feet high they may be seen 50 or more miles, and at 3,000 feet 70 miles. 2. What is the average height above the earth's surface of the approaching storm cloud, as we see it creeping up from the horizon before a thunder or rain storm? Of the cumulus? Of the cirrus? A. Thunderstorm clouds are very variable in height—500 to 2,000 feet. The clouds in thunder storms may be very deep, two to five miles, and more. Hence the appearance as to distance is very deceptive. Cumulus clouds are intermediate, and generally occupy a position from 2,000 to 5,000 feet above the earth. Cirrus clouds are the highest, and are from 10,000 to 30,000 feet above the earth. 3. What rule may be given for finding the distance of clouds from the place of observation, when their angular distance above the horizon and their approximate height above the earth's surface are known? A. Calculations for the distance and height of clouds are very uncertain, from the difficulty of obtaining correct observations; simultaneous trigonometrical triangulation from a known base, and computation, are the only method of determining the distance.

(4) A. S. B. writes: 1. If, in making a dynamo after the plans of the motor in SUPPLEMENT, No. 641, I wind the armature with No. 24 wire and the field magnet with No. 16, about how many pounds of each will I need? Are these the right size of wire? A. We think the sizes of wire are about right. You will require about 3 pounds of each kind of wire. 2. What is the reason of using cast iron for the field magnet? A. Because cast iron retains sufficient magnetism for starting. 3. I made a galvanometer of a 1¼ inch compass placed over 30 feet of No. 24 wire. When connected with a cell of gravity battery, it was deflected about 95°. I read that a galvanometer was never deflected more than 90°. Is this wrong? A. We think you are mistaken about the deflection of 95°. 4. I made a bichromate battery of two pairs of electric light carbons with a zinc 2 inch by 1 inch. How strong would one cell be? A. Probably 1½ volts. 5. Must the resistance of the wire on the field magnet equal the resistance of the wire on armature on a motor or dynamo? A. Not necessarily.

(5) R. W. writes: I have made a dynamo according to the directions in SUPPLEMENT, No. 161, only I used No. 26 wire instead of No. 18, as recommended in the paper. It works well enough, could it be made to work better by using No. 18 wire? A. It depends entirely upon the use to which you apply the dynamo. No. 18 wire on the armature will give a current of fewer volts, but more amperes. 2. How could I change it to electroplate? A. Wind the armature with No. 10 wire, and the field magnet with No 14. 3. I am also making an eight light dynamo according to directions in a previous number of your paper, but I have used vulcanized fiber between the commutator bars instead of mica. Will the spark burn it out or not? A. Mica is preferable, as vulcanized fiber is apt to burn. 4. I see in the cut of the complete machine that all of the magnet terminals are connected to what seems a switch board. Does this mean, that if the current is shunted through one pair of coils on the field magnet, that the machine generates current enough for two lamps, and so on? Until four are shunted in circuit the machine runs to its full capacity of eight lamps. A. The part you take for a switch is only a support for the wire. By connecting all the wires in series and using the machine as a shunt machine, with some added resistance in the shunt, you will be able to run from one to eight lamps.

(6) W. H. L. desires a good remedy for moths in furniture. A. The continual use of Persian insect powder will drive them away. The noxious principle of the powder, however, soon evaporates, so that its frequent renewal is necessary until all of the moths are killed.

(7) W. R. K. asks if there is any known compound, which will, without material injury, aid in the rapid growth of hair on a young man's face? A. Mixtures containing stimulants, such as cantharides or Spanish fly, are said to be somewhat efficacious, if persistently applied in moderate quantities for a considerable period. Among the mixtures recommended for that purpose is: Cologne 2 ounces, liquid ammonia 1 drachm, tincture cantharides 2 drachms, oil rosemary 12 drops, lavender 12 drops. Apply to the face daily.

(8) F. T. H. asks: 1. What vehicle should powdered soapstone be mixed with, when brick outside walls are to be painted? A. Boil with linseed oil and a small quantity of resin. 2. What to mix it with when iron work is to be painted? A. Linseed oil. 3. Also please explain why, when a ⅛ inch glass tube is introduced into water, the water level in the tube is always about an eighth of an inch above the normal level? A. On account of capillarity, for a description of which see Sir William Thomson's lecture in the SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 562, 563, which we can send you for ten cents each. 4. In running electric wires through gas mains, is there any insulation in the market that will effectually resist the chemicals usually found in gas mains? A. A wire insulated and coated with lead over the insulation would be most effectual. Most other styles would quickly or slowly deteriorate.

(9) F. L. D. asks the power required to drive a 30 foot boat at a speed of 12 miles per hour. It is built on what is known as the "skip jack" model, is 8 feet beam and 33 inches flat on bottom. It was built by an experienced boatman, and cuts the water very smoothly. A. It is extremely doubtful if you can accommodate engine, boiler, and wheels of sufficient size to drive your boat 12 miles per hour. We do not know how much draught nor the kind of wheel you propose. A 6 x 12 cylinder with 8 horse power boiler, carrying steam at 100 pounds pressure, connected direct to a stern wheel 8 feet diameter, will realize 10 miles per hour at 50 revolutions per minute.

(10) J. R. B. writes: 1. I have an ivory rule which has become yellow from age. Is there any way to restore it white again, without injury? A. Place for a short time in a gently heated thin lime paste. 2. Do spoke manufacturers use good glue alone on their sand belts, or do they put something in to make it elastic? A. Common brown glue is better than the best glue, and will answer alone.

(11) C. T. C. asks: 1. How can certain unsightly objects in a photograph be removed, for instance, a lock of hair, a mole, etc.? A. Only by retouching the negative, or using powder, etc., on the face before taking the picture. 2. What oil should be applied to shoes to make them more flexible, impervious to water, and durable? A. Use neat's foot oil moderately and well rubbed in after the leather has been sponged off, and while it is still damp. 3. Where is a good place for buying chemicals and scientific apparatus for amateur experiments in the home circle? A. Consult our advertising columns.

(12) W. H. D. desires a recipe for a first class office mucilage. A. Use the following preparation: Gum dextrin 2 parts, water 5 parts, acetic acid 1 part; dissolve by heat and add 1 part of alcohol.

(13) C. D. A. desires directions for moulding small articles of soft rubber. A. The process is analogous to that described under "The Making of Rubber Stamps," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 569. See also the series of articles giving very full details on the manufacture of rubber in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 249, 251, and 252.

(14) L. J. J. asks what the common leader used for fishing is made of? A. Silk worms are broken in two and drawn apart, and the silk-forming matter, which is pulled out into a thread between the two pieces, hardens in the air, and forms the so-called "gut" leaders.

(15) W. S. asks (1) how breaking strain on suspension bridge cables is computed. A. The strains are generally computed on the assumption that the curve is a parabola. 2. What cheap and effective way to destroy or drive small red or brown ants from and around the house? A. Try a good insect powder. 3. What is your charge for assaying ores for gold and silver, etc., also for analysis of ores? A. From five dollars upward.

(16) H. & W. ask: 1. What is the best walnut stain? A. Take of spirits of turpentine 1 gallon, pulverized asphaltum 2 pounds, dissolve in an iron kettle on a stove, stirring constantly. Can be used over a red stain to imitate rosewood. The addition of a little varnish with the turpentine improves it. 2. What is the best preparation, and how made, for putting on the strings used in sealing fruit jars, etc.? A. Dissolve one pound of sulphate of zinc in 40 gallons of water, and then add 1 pound of sal soda. After these ingredients are dissolved, add 2 ounces tartaric acid. The cord should be soaked in this solution for twenty-four hours and then dried without wringing.

(17) A. M. M. writes: 1. I have a small rule made of bone, which I broke. Is there a cement that will mend it? A. Take of isinglass 1 ounce, distilled water 6 ounces, boil to three ounces, and add rectified spirit 1½ ounces, boil for a minute or two, strain, and add while hot, first a milky emulsion of gum ammoniac ½ ounce, and then tincture of mastic 5 drachms. 2. Which will give the most heat, a gallon of gasoline or a gallon of kerosene, for steam boilers? Which would be the safest to burn? A. Kerosene is the safer, and will give most heat.

(18) A. G. and others ask: When does the next century begin? Some claim that it is January 1, 1900, while I claim that it commences on January 1, 1901. A. It commences January 1, 1900. The Christian era was not promulgated until long after the birth of Christ, the Roman calendar being then used—its beginning being assigned as the first of January, in the fourth year of the 194th Olympiad, the 753d from the foundation of Rome, and the 4,713th of the Julian period. By the computations of several authors, the date of the birth of Christ varies several years before and after the assigned date of the Christian era.

(19) H. W. D. asks (1) if the coil described in SUPPLEMENT, No. 160, is wound with No. 35 instead of No. 36 wire, will it do just as well, and what size spark should it give? A. The increase in the size of the wire is so slight as to make no material difference in the action of the coil. 2. If I should make a coil the size of the figures instead of twice the size, wound with No. 36, what size spark will it give? If coil is made as in question 2, but wrapped with No. 35 instead of No. 36, what size spark will it give? A. From ¼ inch to ⅜ inch. 3. What is cartridge paper? A. Heavy, highly calendered manila paper.

(20) T. W. asks for some metal or alloy that will neither expand nor contract with heat or cold. And which metal expands most with heat, and the amount of expansion in a piece of the same metal ten feet long? A. No such metal is known. The condition is obtained by a combination of metals in the gridiron pendulum. Of common metals zinc expands the most; between freezing and boiling temperatures, 32° and 212° Fah., it expands $\frac{1}{112}$ of its length—about $\frac{1}{10}$ inch for a piece 10 feet long.

(21) B. J. H. asks: What is the simplest method for finding the altitude of a given place? Is a barometer used? And if so, where can the same be obtained? A. The mercurial barometer may be used with reasonable accuracy, or a line of levels may be run with still greater exactness. Any dealer in scientific instruments can supply you with desired requisites.

(22) G. A. V. asks whether three small screw wheels running side by side and geared together from center shaft would be better than stern paddle wheel for light draught flat bottom river boat drawing one foot of water. A. No. It is well established by trial that the stern or side wheel only will do well with shallow draught vessels.

(23) C. H. F. asks the English and also the American standard of pipe tops, the pitch of thread taper, and size of point of tap? A. ⅛ inch pipe 27 threads to 1 inch, ¼ inch and ⅜ inch pipe 18 threads to 1 inch, ½ inch and ¾ inch pipe 14 threads, to 1 inch, 1 inch, 1¼ inch, 1½ inch and 2 inch 11½ threads to 1 inch, 2½ inch up 8 threads to 1 inch. All threads taper ¾ inch to 1 foot on each side. End of taps should be one-sixteenth inch smaller than diameter of bottom of thread at end of pipe, using pipe thread as a gauge.

(24) C. H. L. asks: Can you tell me whether quicksilver standing a long time in a brass tube will injure the metal? What effect, if any, does it have upon brass? A. It will quickly amalgamate the brass, destroying its strength and forming a soft and brittle alloy.

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June 5, 1888,

AND EACH BEARING THAT DATE.

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