SCIENTIFIC AMERICAN

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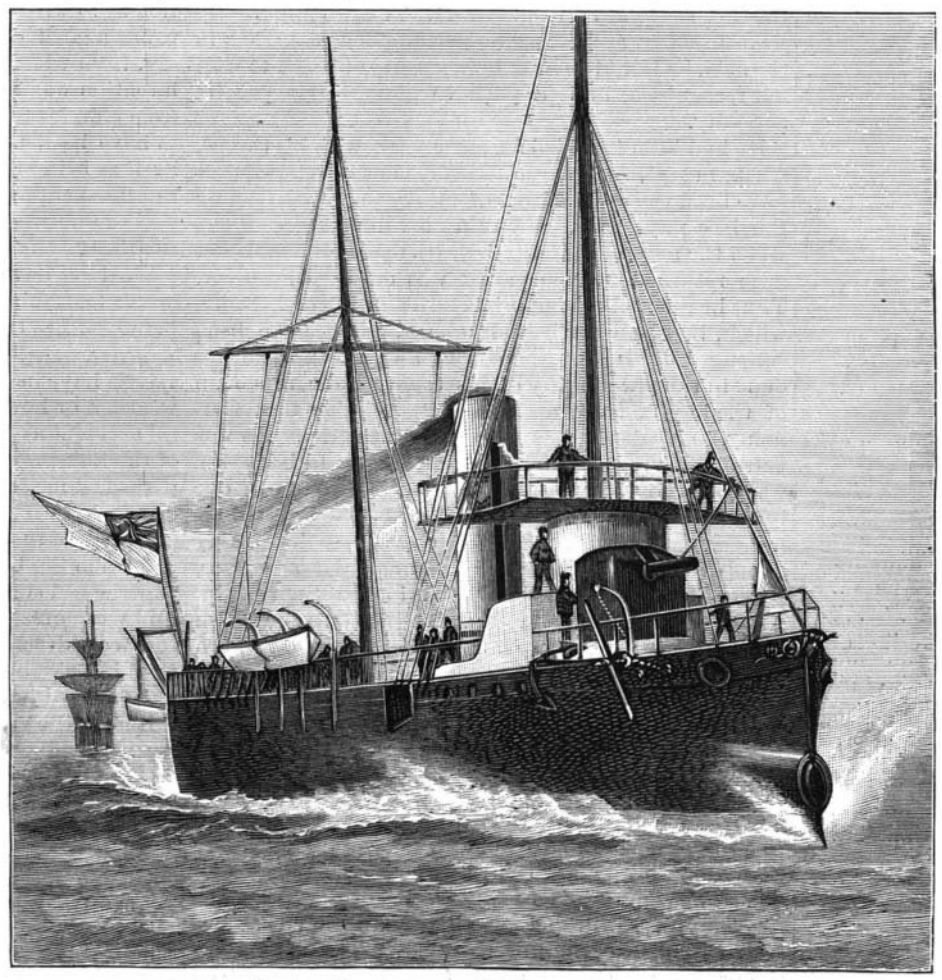
INSIDE AND OUTSIDE OF A TORPEDO VESSEL—H. M. S. RATTLESNAKE.

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.

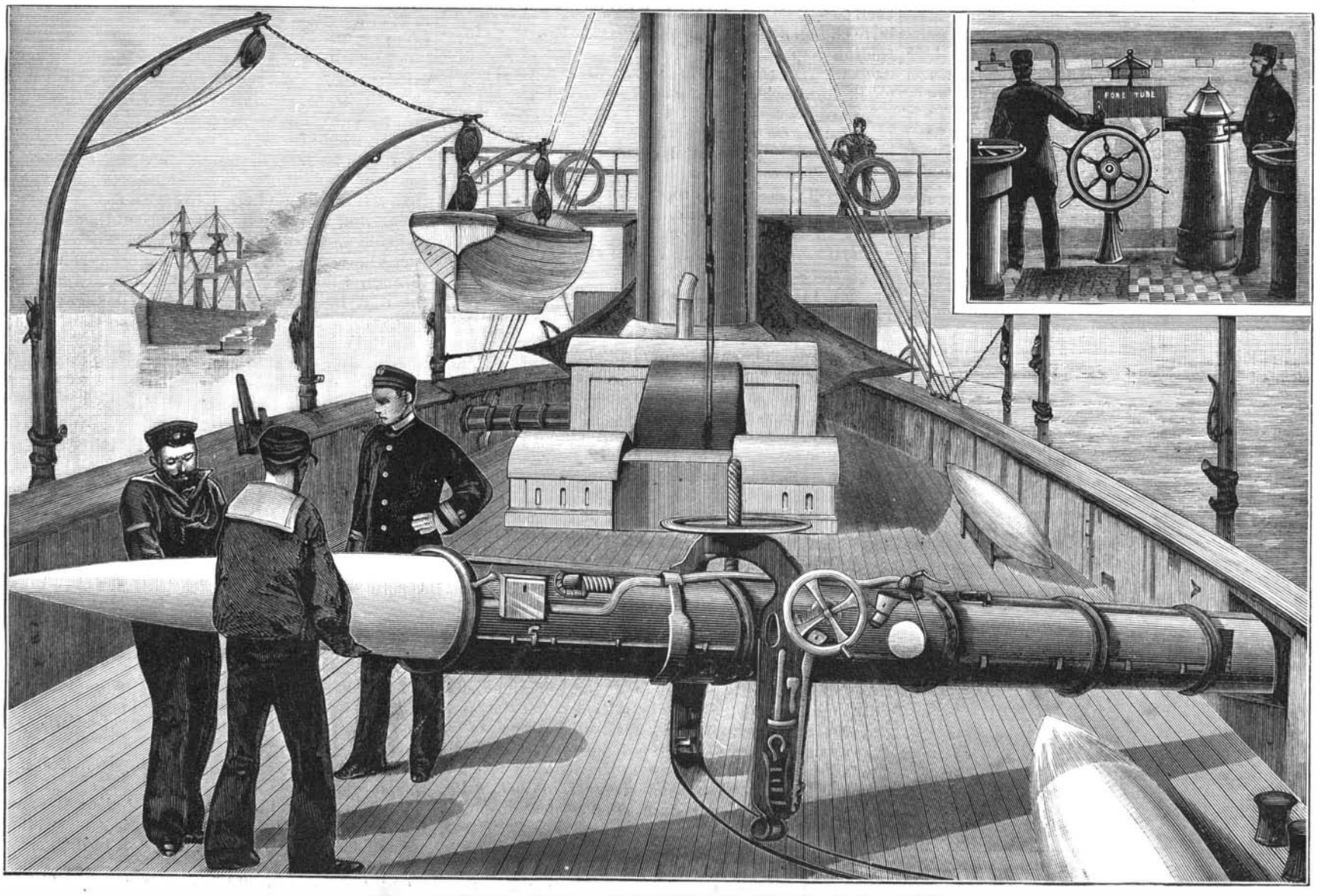
So pleased were the Admiralty with these boats, that they determined at once to augment the number by seven, thus making eleven in all; though the latter will be somewhat like the first named, they will be of greater tonnage, and, instead of carrying but one, will mount four guns. The Rattlesnake, though 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.)

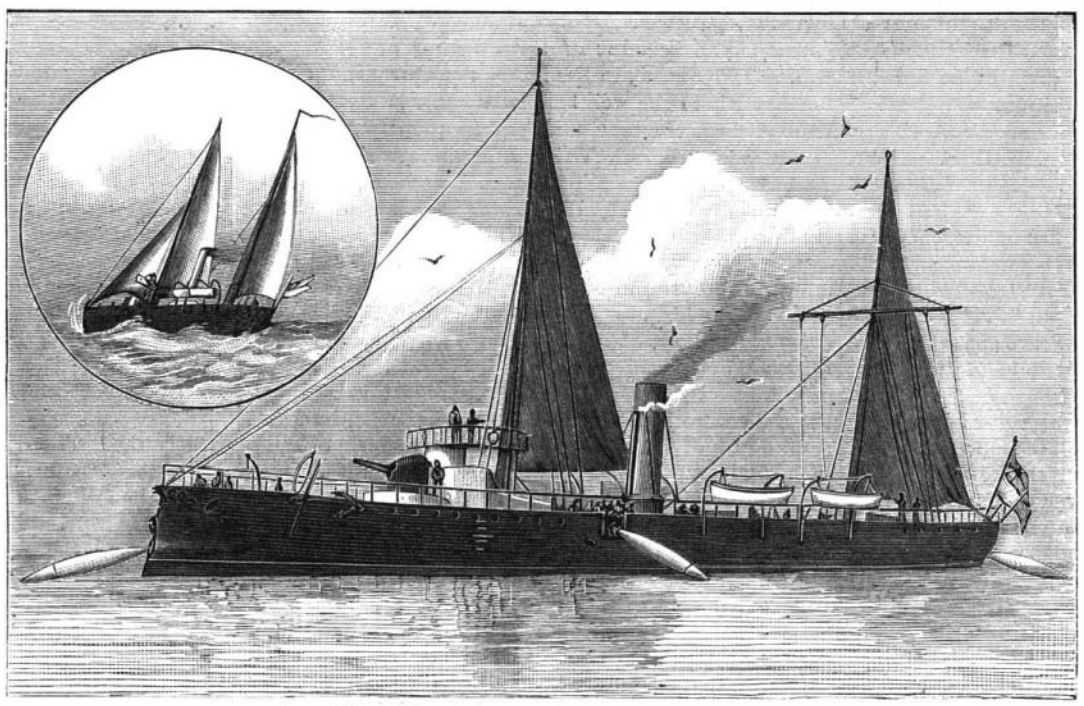


THE TORPEDO BOAT RATTLESNAKE—MAIN DECK VIEW.

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.*

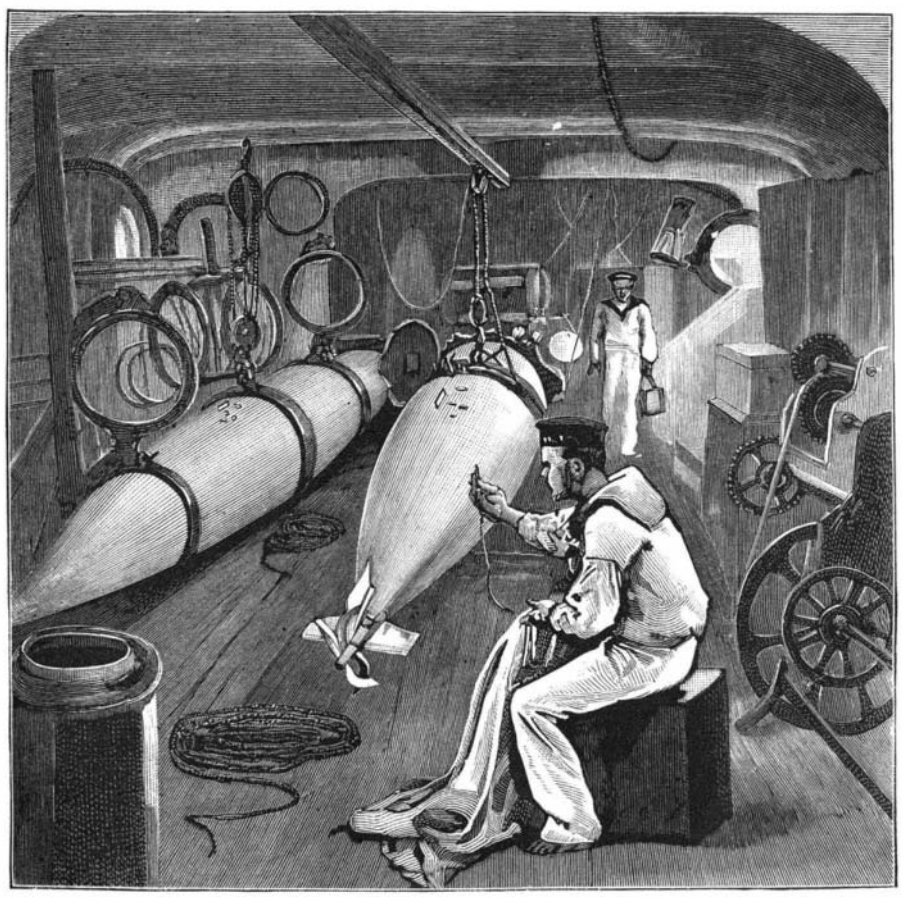


THE RATTLESNAKE LAUNCHING TORPEDOES.

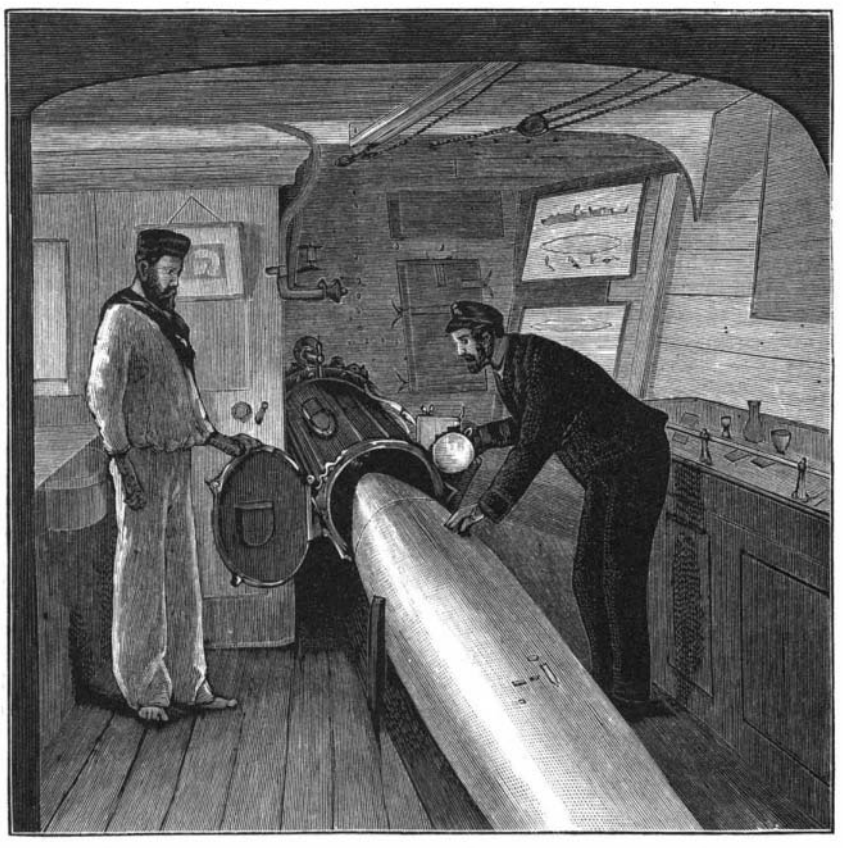
Modern Heavy Artillery.

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 $3,350,000, 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.

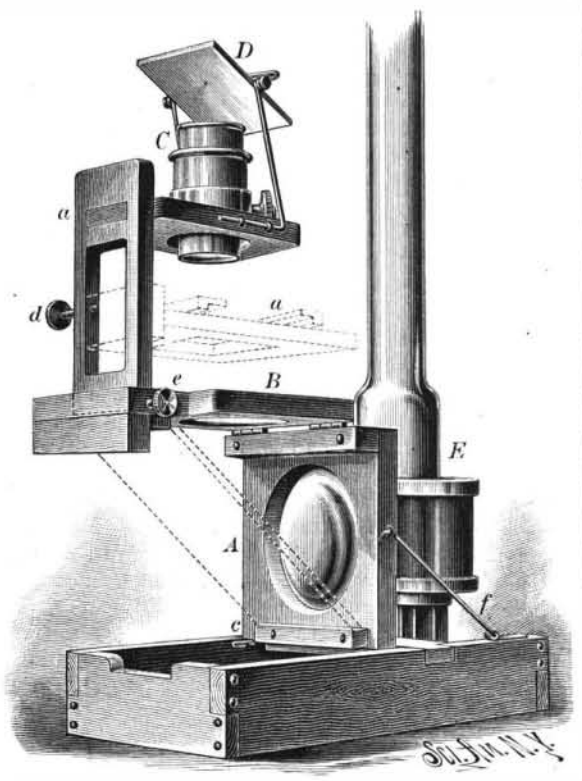


Fig. 3.—LANTERN ARRANGED FOR VERTICAL PROJECTION.

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.

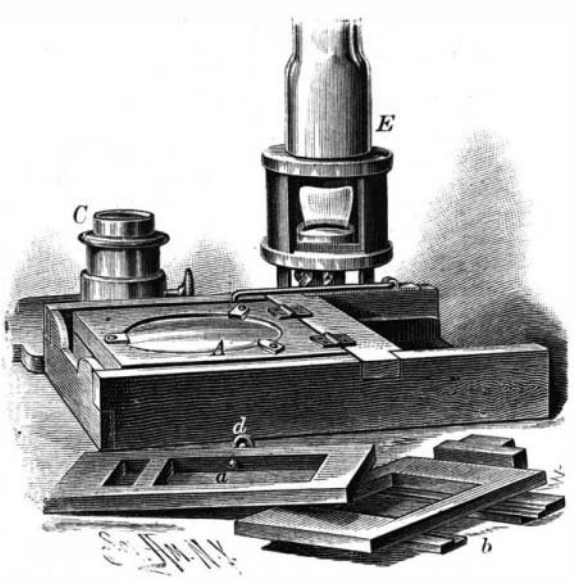


Fig. 1.—PORTABLE LANTERN TAKEN APART.

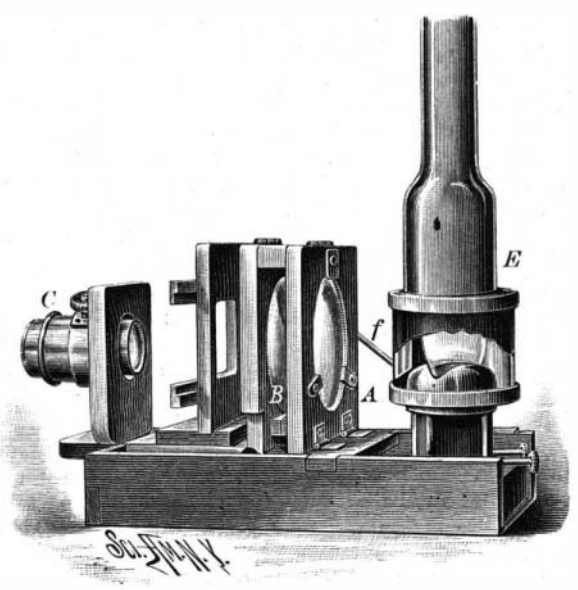


Fig. 2.—LANTERN ARRANGED FOR HORIZONTAL PROJECTION.

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.